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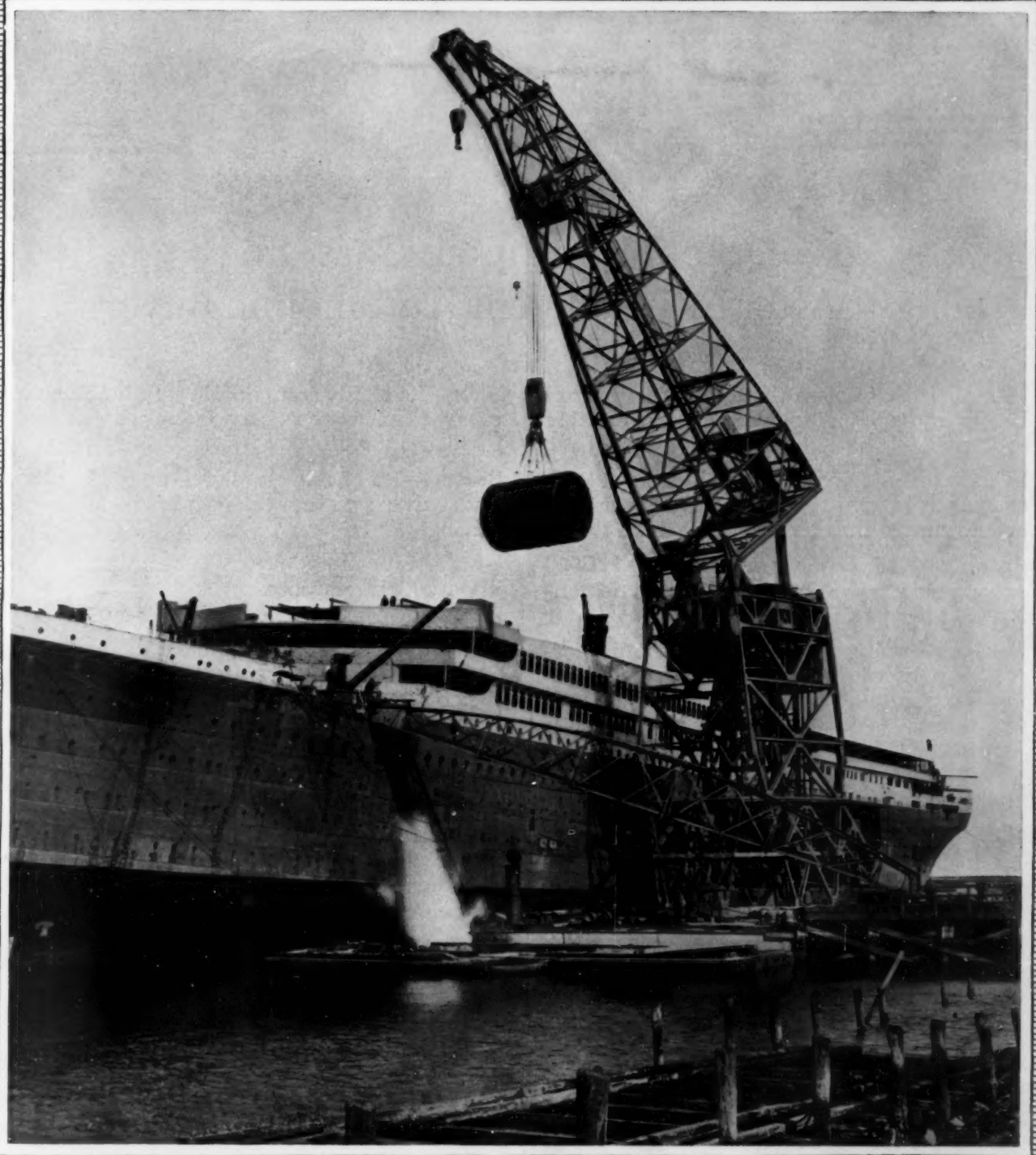

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Vol. CX. No. 21
May 23, 1914

Munn & Co., Inc., Publishers
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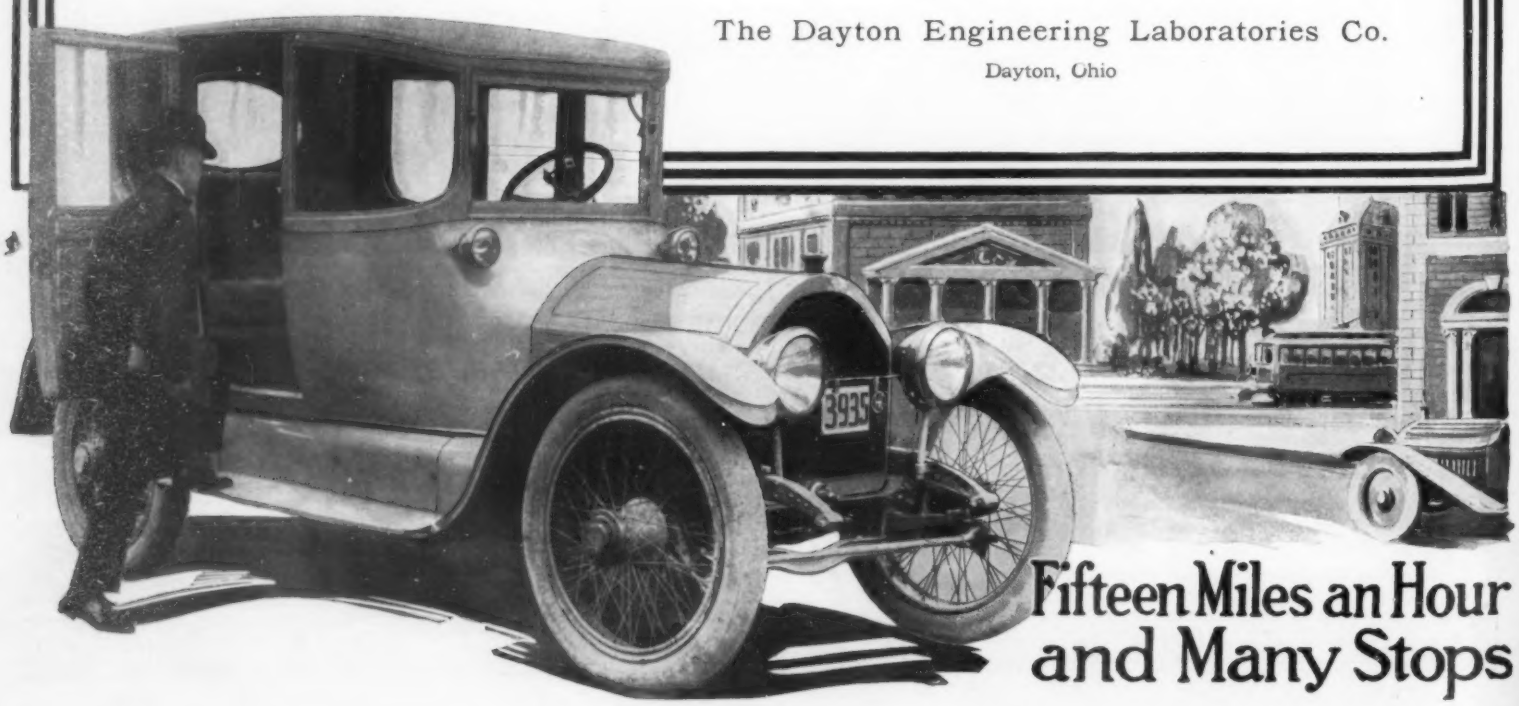

Fifteen Miles an Hour and Many Stops

SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CX]
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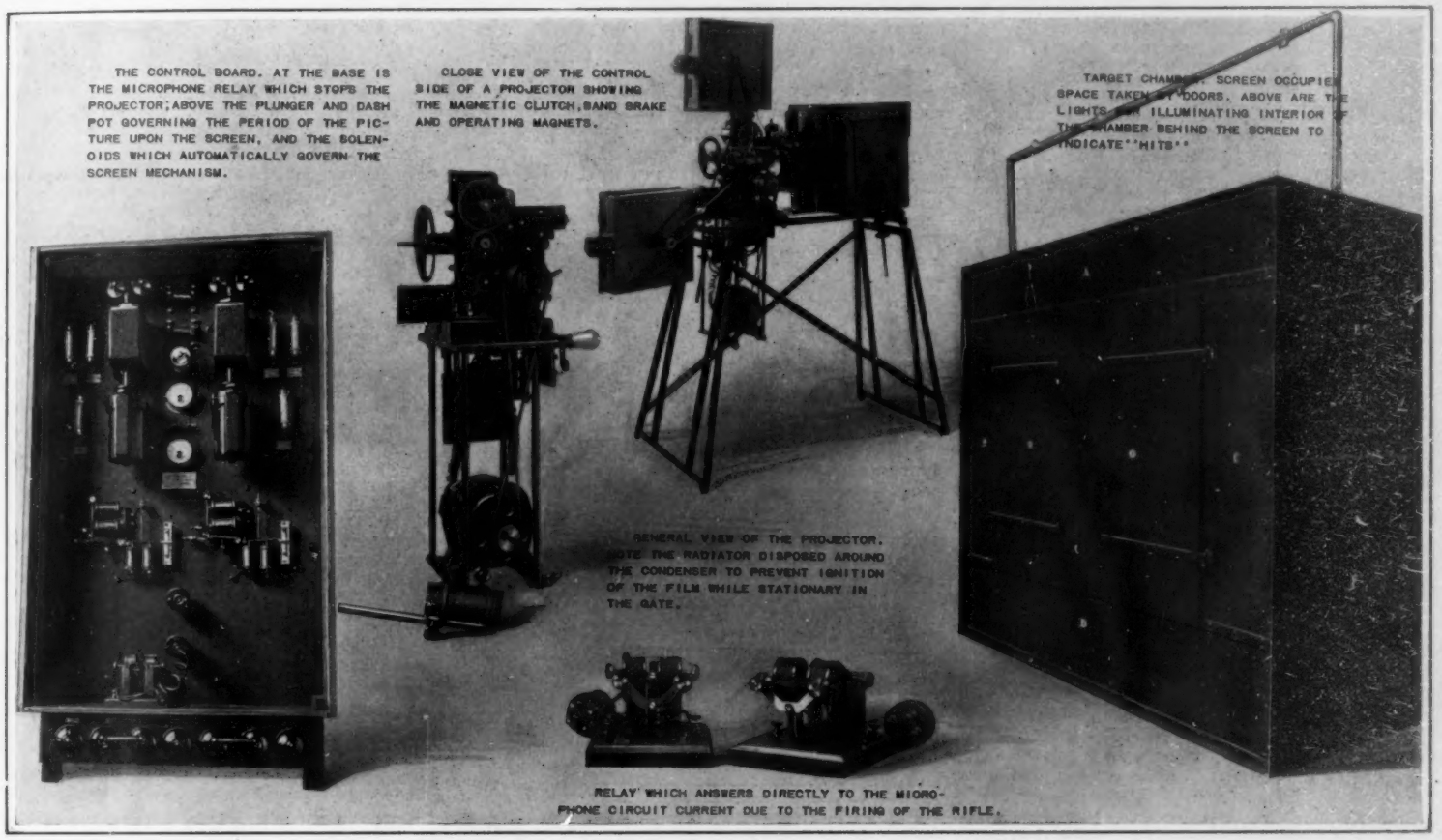

Improved kinematograph target apparatus used in England to train sharpshooters.

Training Marksmen by the Kinematograph

FOR some years past considerable ingenuity has been expended in the effort to turn the kinematograph to distinct value in the training of marksmen. Unfortunately the problem was attended with many peculiar difficulties, that of accurately and instantaneously recording a hit upon the moving subject being the most elusive. In order to render the application of any pronounced value, both to the recruit and to the officer in charge, it is imperative that the hit shall be shown upon the screen.

Recently such a system has been perfected in England, and has met with warm approval from military experts. Briefly, the system comprises the projection of pictures upon a moving screen, which is perforated by the bullets, the hit being revealed by a light showing through the puncture, and the picture being held stationary for a few moments to enable the full results of the hit to be observed.

While the apparatus is necessarily somewhat intricate, its operation is extremely simple and automatic throughout. The projector follows the usual lines with a few special attachments to adapt it to this application. The screen is of special design, and is formed of traveling rolls of paper, the movement of which is controlled by the lantern mechanism.

The essential feature of the invention is a very sensitive microphone, which is connected to a delicate relay. The microphone itself is set up above the screen out of the firing line. When a shot is fired the report of the discharge is caught by the microphone and brings the relay into operation. This relay controls a magnetic clutch placed upon the motor drive of the projector, and, at the sound of the shot, this clutch is brought into operation, the drive is interrupted, and a powerful instantaneous brake applied to arrest the movement of the projector, with the result that the image of the film at which the marksman fired upon the screen stops in the gate, producing the same steady stationary image as if it were a lantern slide. The blades, or opaque sectors, of the revolving shutter are mounted in a free wheel manner, so that although the projector mechanism is stopped the blades continue to revolve at normal speed. Consequently, although the picture is stationary upon the screen the light is intermittently cut off as in ordinary kinematography.

While the microphone and relay are essential parts of the invention the screen moving mechanism is in every way as important. The screen itself is carried upon the face of a large iron box, the back wall of which forms an impenetrable obstacle to the bullets. The front space of the front wall of this chamber is filled entirely by the screen. At the bottom is a roller on which the paper is coiled. The free end of the paper is then carried upward to the top of the space, where it is passed over a second roller, and down once more to be wound upon a second bottom roller, mounted above the first one. Consequently, as the paper is fed upward and round the top roller it descends to the third roller to be coiled up, and as the movement of these two lower rollers is identical and synchronous the tension of the paper is maintained. In this way two traveling thicknesses of paper are provided, the foremost moving upward and the one behind moving downward. The movement, however, is not continuous, but intermittent, and is governed by the mechanism acting in conjunction with the microphone and relay.

But in addition to the foregoing two thicknesses of vertically moving paper there is a third sheet. This is coiled at one side upon a vertical roller, passed across the screen space behind the two above-mentioned thicknesses of paper and wound upon a second vertical roller at the opposite side. This sheet is employed to serve as a stiffener to the two thicknesses in front, and is kept very taut. It also reduces the possibility of showing a repeat hit. The sheet is moved by hand at various intervals, according to the extent to which the target is used. In some instances movement of an inch or two in a horizontal direction once an hour is quite adequate. It will thus be seen that the screen in reality comprises three thicknesses of paper superimposed vertically, two of which travel in a vertical direction, while the third moves in a horizontal line.

Behind the screen, within the steel chamber, but out of the firing line, powerful electric arc or incandescent lamps are fitted. Thus the interior of the chamber is brilliantly lighted, but this fact is not apparent from the front because the paper screen forms an opaque wall.

When the shot is fired it penetrates the three thicknesses of paper, and the light placed behind showing through the puncture indicates exactly where the bullet has struck. As the picture at this juncture is stationary upon the screen, it is possible to determine at once from the position of the shot-hole relative to the subject of the picture whether the shot was effective or otherwise. For instance, if the picture represents a sharpshooter firing from behind cover, the officer can ascertain immediately whether his man at the firing line hit his opponent, and if such were done before the latter fired.

The duration of the period for which the picture stands stationary is governed from a control board, which is automatic in its action. The relay connected to the microphone is mounted at its base. At the extreme top are coils serving as magnetic blowouts to quench the induction spark of the screen-shifting mechanism, which is a solenoid automatically operated from this point. Immediately below are timing solenoids and a dash pot and plunger. As soon as the projector mechanism is arrested, and the picture is brought to a standstill upon the screen, this plunger commences to move. When it has reached the limit of its travel it re-establishes contacts, which sets the screen mechanism in operation. By varying the travel of this plunger the stationary period of the picture upon the screen may be varied within certain limits, according to circumstances.

The screen mechanism is very simple. On the horizontal roller upon which the paper is coiled to be unwound is a ratchet and pawl movement actuated by a solenoid. When the plunger on the control board reestablishes contact the ratchet of this screen roller is moved, and the outer sheet of paper moves upward for a distance of one eighth of an inch, the return or second sheet moving a corresponding distance downward simultaneously. As the two sheets are displaced in opposite directions the shot-hole in each, through which the back

(Concluded on page 436.)

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Energy from the Sun

IN view of the fact that the sun delivers energy to the earth at the rate of 7,000 horse-power per acre, it is not surprising that the problem of devising a motor which shall transmit this energy into useful work has proved an attractive one to the experimentalist, as a study of the files of the SCIENTIFIC AMERICAN during the past few years will show. Thus, in California there was erected a plant in which the heat rays were made to converge upon a steam boiler, that generated sufficient steam to run an 8-horse-power pump—this plant being an elaboration of Ericsson's early experiments upon which he is credited with having spent $150,000. Two more modern and perhaps better-known installations are those erected at Philadelphia, and later at Meadi, Egypt, the plants in these two experiments being designed on the principle of concentrating the sun's rays upon a boiler of large area and very low pressure.

An analysis of the Egyptian plant, made by Mr. A. S. E. Ackermann, B.Sc., in a paper read recently before the Society of Engineers in London, shows that, while these experiments have decided scientific interest, they give but little promise of the commercial success of the sun motor. The temperature of the sun is estimated to be about 6,000 deg. Cent., and, theoretically, about 95 per cent of this should be convertible into work. The energy convertible into mechanical work falls from 95 per cent of 7,000 horse-power per acre to 25 per cent, or say, 1,750 horse-power per acre. Even this amount cannot by any means be realized in practice. In some regions the atmosphere cuts it down by nearly fifty per cent, though the loss is considerably less in arid areas.

Recently Mr. Ackermann made a series of trials at the Meadi plant which extended over three weeks; during which he was able to record as the highest output only 19.1 pump horse-power from a sunshine-absorbing plant covering seven-eighths of an acre. That is to say, he recorded less than 20 pump horse-power, as against the 6,000 horse-power which would have been obtained from a perfect motor, capable of utilizing the sun's radiation direct. In the Philadelphia plant, in a test lasting for five hours, Mr. Ackermann obtained results equivalent to the development of an average of 18.54 horse-power from a sunshine-absorber of 0.41 acre extent. The maximum development in the test was 26.8 horse-power and the lowest 8.6 brake horse-power.

These results show how little promise there is of obtaining mechanical energy from the sunshine on a commercially economical scale. Such plants as these at Philadelphia and in Egypt suffer, in an exaggerated form, from the drawbacks attaching to wind power, namely, the great area occupied, the costly cumbersomeness of the plant, and the great variability in the rate of power production. A windmill 40 feet in diameter has an output of about 8 horse-power, and costs $250 per horse-power; and it can be relied upon to work not more than one third of the total number of hours in the year.

In the Meadi plant the five steam generators consist each of a huge mirror, 201 feet long by 14 feet in width, which concentrates the rays on a cast-iron boiler, 3½ inches by 14¾ inches by 205 feet long. The mirrors are mounted on rollers and follow the sun from east to west. The plant gives the best results when working with a steam pressure of 6½ pounds gage. In the Meadi test the engines did not work well, and the steam consumption was very high. But even with low-pressure turbines, the output in brake horse-power would amount to an average of only 70 brake horse-power per acre. This means that a 1,000-kilowatt plant would call for a gathering ground of nearly 14 acres, and even this would be available at the above rates for not more than about three thousand hours per year under very favorable climatic conditions.

Of course there would be a great increase in the output, if the steam pressure were raised, say, to 200 pounds per square inch; but since a sun motor must be placed in the open air, the increased losses due to convection would greatly offset any gain due to the higher pressure.

Construction of Battleships at Government Yards

THE question of the wisdom of constructing battleships at Government yards once more has been the subject of debate in the House of Representatives, when the arguments in favor of the policy were strongly urged by Representative Fitzgerald of New York. For many years the SCIENTIFIC AMERICAN has advocated the policy of having at least one battleship under construction at one or other of the navy yards; and the arguments which we advanced many years ago when the subject was first under discussion are valid to-day.

The country has at least one yard, that at New York, which is fully equipped for building dreadnoughts of the largest size. In fact, the keel has just been laid of a ship which is to-day the largest under construction for any navy. There have been successively built at this yard, during the past twelve years, the "Connecticut," the "Florida," and the "New York." The work on each ship was absolutely first-class, and in the case of each there was an increase in the rapidity of construction over its predecessors.

The principal arguments in favor of Government construction are, first, that a spirit of healthy rivalry is promoted between the Government and the private shipbuilding yards, and, secondly, that the construction of a battleship serves to keep together a large navy yard working force, which, if there were no such work on hand, would have to be more or less broken up and scattered during the slack season. As to the first condition, it is sufficient to refer to the facts brought out by Mr. Fitzgerald that, when the Government yards were first utilized for the construction of battleships, contractors took from 36 to 40 months in excess of the contract time in which to complete them; whereas to-day vessels authorized for the Navy, because of the keen competition of the Government yards, are completed within the time fixed by contract.

The advantages of maintaining a large working force of skilled mechanics, continually, at such a yard as New York is self-evident. Now that so many of the minor repairs are done aboard ship, there is not sufficient overhaul work at the yards to keep the force up to its full quota. That the private establishments understand full well the economic value of holding together a thoroughly drilled force of workmen is proved by the fact that they will often, in slack times, take work at cost or very little above cost, merely for the sake of holding their forces together and keeping their plant in operation.

There is the further and very forcible argument that in the event of hostilities, when the yards have to be suddenly worked to their fullest capacity, the existence of a large body of trained and well co-ordinated forces would be of inestimable value.

Col. Roosevelt's Discoveries in South America

DURING the last two or three years the northern drainage slope of the Amazon basin has been much more fruitful than the southern of geographical discoveries, including the notable achievements of Hamilton Rice, Koch, and Farabee. It is therefore a matter of special interest that the Brazilian expedition of the American Museum of Natural History, led by Colonel Roosevelt, has traversed a long stretch of virgin territory among the southern tributaries of the great river, and made important additions to the map in the very heart of the region which most contemporary cartographers mark "Unexplored." Colonel Roosevelt was accompanied by the experienced naturalists George K. Cherrie and Leo E. Miller, of the American Museum, his son Kermit, and a Brazilian commission headed by Colonel Rondon, who was previously well known in connection with official surveys in the interior of Brazil.

That the results of this expedition will prove extremely valuable is sufficiently attested by the fact that the explorers collected over 2,100 birds and mammals, besides a number of reptiles, batrachians, and fish, mainly in regions not previously visited by naturalists. The principal geographical achievement of the expedition is claimed to have been the mapping of a river nearly a thousand miles long, the existence of which had previously been only vaguely known or suspected, and which, on account of its problematical character, had acquired the name Duvida ("Doubt"). The Colonel's description of this stream is as follows:

"The upper part of its course was utterly unknown to anybody except the wild Indians along its banks, while the lower part was known to a few rubber men only. The river takes its rise in the high uplands of the western part of the state of Matto Grosso, just north of the thirteenth parallel of south latitude, and between longitude 59 and 60 west of Greenwich.

"We embarked in latitude 12 degrees 1 minute south and longitude 60 degrees 15 minutes west.

"The river ran with many doublings and twistings, almost due north into the River Madeira, where its entrance was at about 5 degrees 30 minutes south latitude.

"In latitude 10 degrees 58 minutes south we struck the mouth of a big affluent flowing from the right and in latitude 9 degrees 49 minutes south we came to the mouth of another affluent flowing from the left.

"The Duvida River in point of volume is like the Rhone, the Elbe, or the Hudson, but is too much broken up by rapids to be navigable except in the lower parts. In about 7 degrees 30 minutes south latitude it joins another river, practically the same size, flowing from the right.

"From about 11 degrees 48 minutes to 10 degrees 48 minutes south latitude the course of the Duvida is almost an unbroken series of rapids, there being no clear day's run without rapids."

Though not questioning Roosevelt's good faith, several geographers have expressed doubts as to the accuracy of the statements above quoted. The Madeira River, of which the Duvida is said to be a tributary, is not only well known, but regularly navigated by steamers far above the point where the Roosevelt party claims to have entered it from the newly found river. How could this great tributary have hitherto remained unknown to the many people who travel up and down the Madeira? An unnamed explorer whose views are quoted at length in the English press suggests that the Colonel may have sailed down the Tapajos, while Sir Clements Markham is inclined to think that he descended the Canuma, the greater part of which has never been explored. In either case, as he undoubtedly entered the Amazon by way of the Madeira, he must have reached the latter by some unknown cross-channel, or, according to one suggestion, by way of a temporarily flooded lowland. The journey was made at the close of the rainy season, when, as is well known, South American rivers indulge in curious freaks.

The best maps of the Amazon region, such as Mello's "Atlas do Brazil," the large Olavo Freire map, and the great German atlases of Stieler, Andree, etc., throw little light on this question; in fact, a comparison of these maps with one another shows unmistakably that the cartography of the whole region where the Duvida is supposed to run is, at present, merely conjectural. The reported starting-point of the canoe journey corresponds closely with a supposed upper portion or branch of the Jamary, a tributary of the Madeira, and the relief of the country in this immediate vicinity negatives the probability of the explorers having entered the drainage system of the Tapajos. It is, however, by no means certain that the river shown at this point (on most maps by dotted lines) is really connected with the Jamary. It may well be the Duvida. Following the alleged course of the latter northward we find only one cartographic feature inconsistent with its existence; viz., the Rio Machado, which if correctly shown on the maps, would intersect it at right angles. Here, again, however, we have to do with a river whose course is largely a matter of rumor and conjecture.

What at first sight appears to be a serious objection to the explorer's claims, viz., that so important a tributary of the Madeira would have been well known long ago to navigators of the latter river—is easily disposed of by reference to Roosevelt's description of the Duvida. A river broken by innumerable rapids and exceedingly difficult to navigate even in a canoe might well have remained unexplored except near its mouth. Most of the streams entering the Madeira from the right are shown on the best maps by dotted lines, except at their immediate juncture with the main river; and one of these is, in all probability, the Duvida.

We believe that the Roosevelt expedition has made a notable addition to the map of Brazil.

Engineering

Panama Canal Open to Commerce.—Unostentatiously and without any ceremony whatsoever, the world's traffic through the Panama Canal is shortly to be inaugurated by the passage of a mail steamer of about 5,000 tons from the Pacific to the Atlantic. The clearing of the Cucuracha slide has proceeded sufficiently far to allow of the passage of a ship of this size. The opening was hastened forward by the congestion of freight due to the closing of the Tehuantepec Railway.

Barges for the New York State Canal.—The New York State Barge Canal will have a capacity to pass barges of 2,000 net tons. The dimensions of the barges will be: Length, 275 feet; beam, 30 feet; and draft, 12 feet. The total lift through locks of the Barge Canal is 16 times that of the Panama Canal, and it has 10 times the number of dams, 14 times as many locks, and 20 times as many structures. The cost, as far as construction and engineering is concerned, will be within the estimated cost—a fact for which full credit should be given.

A Fatal Omission.—One of the greatest needs of the Navy just now is the large drydock which is under construction at Pearl Harbor, Hawaiian Islands. During the recent debate on the Navy Bill in the House, however, the "little navy" men succeeded in casting out the provision for this dock, on a point of order. This makes it impossible for the contractors or the Navy Department to complete the construction of this most important work. Apart from the urgent need for the dock, it is a fact that unless the provision is put back in the bill in the Senate, the Government probably stands to lose all the money it has expended on this improvement.

Zoelly Turbine Installation.—The recently constructed electric station for the city of Paris in the suburbs at St. Ouen, employs among others two steam turbine groups designed by the Société Alsacienne. These turbines are connected to alternators on the same shaft. Of the Zoelly type, the present turbine develops 15,000 horsepower and operates at 1,250 revolutions per minute. By the automatic working of a by-pass, it is able to develop 50 per cent above the normal for a short time. The Zoelly wheel works on the impact principle, and the present design allows of adopting periphery speeds which are relatively high. Wheel disks are forged in a single piece with the hub, and the blades are dovetailed around the edge of the disk.

The Most Powerful Locomotive.—What is probably the largest sudden increase in the size of locomotives has taken place in a new freight locomotive, built by the Baldwin Works to serve as a pusher over heavy grades on the Erie Railway. The engine is of the Mallet articulated type; but its weight and power have been greatly increased by adding a third pair of cylinders and a set of six-coupled driving wheels, which are carried by the frame of the tender. The boiler has 6,886 square feet of heating surface, and the steam is utilized in one pair of high pressure cylinders and two pairs of low pressure cylinders, all of which are of 36 inches diameter by 32 inches stroke. The working pressure is 210 pounds to the square inch, and the drawbar pull is 80 tons. The total weight is 477½ tons, of which 376½ are upon the drivers.

The Location of the Alaska Railway.—Now that the Government has decided to build the Alaska Railway, one of the first questions to be determined will be that of the selection of the engineer to lay out the best location for the road. The locating of a new line is the most important work that the engineering staff of a new railroad have to do. The locating engineer is a specialist. Upon his good judgment depends the question as to whether the completed road is to cost so many million dollars more or less; and in the selection of the man for this work, political considerations should have no weight whatever. If the Government wishes to show how well it can lay out, construct and equip a railroad, it should select its staff entirely upon their merits, that is to say, upon the work which they have done under conditions approaching those which will be met with in Alaska.

Combined Rack and Adhesion Locomotives.—The railroad line running between Usui and Toge is obliged to run upon very heavy gradients when on the mountain, the difference of level being some 1,760 feet over a length of but 7 miles. On this portion there was used a rack-rail system of the Abt design and some 20 locomotives specially employed for the mountain stretch, ordinary locomotives being used on the other parts of the railroad. Lately the steam locomotives were replaced by electric locomotives of the Allgemeine type, designed to run on 600 volts continuous current with third rail. The locomotives are designed on the combined adherence and rack-rail system, and are said to be the most powerful rack-rail electric locomotives yet built. The electric motors are mounted on the car floor, and drive a countershaft by gearing, whence a driving bar system operates the wheels. The rack wheels are driven by a separate mechanism.

Science

Water-Proofing Concrete.—The United States Army Engineers have long used the following mixture in waterproofing cement: One part cement, two parts sand, three quarters pound of dry powdered alum to each cubic foot of sand. Mix dry and add water in which has been dissolved three quarters pound of soap to each gallon. This is nearly as strong as ordinary cement, and is quite impervious to water besides preventing efflorescence. For a wash, a mixture of one pound of lye and two pounds alum in two gallons of water is often used.

Teak Forests in Java cover 1,480,000 acres, and, as the area reafforested is two and a half times as large as the area felled in a given time, this magnificent stock of timber is continually increasing. A pest of the Java teak plantations is alang grass (*Imperata arundinacea*). In order to prevent the incursions of this plant, as hoeing is too expensive, the foresters sow a leguminous plant, *Leucena glauca*, between the rows of teak seedlings. This chokes the alang, keeps the soil clean, and enriches the soil in humus and nitrogen, and ultimately disappears with the increase of the forest cover.

Some High Ocean Waves.—Regarding the greatest height of waves reported by different observers, Lieut. Raffi of the "Jules Henry," recently noticed waves of 66 feet in the Atlantic. But this does not appear to be the highest on record. In 1863 Admiral Fitz-Roy affirmed in his "Weather Book" to have seen waves of 60 feet. Capt. Kiddle of the "Celtic" observed 70 feet height, and the same figure is also reported by the commanding officer of the "Narrung" in the region of the English Channel during the tempest of last winter which prevailed on the Channel and the North Sea. It is not stated how the observers estimated the height of the waves, so that some latitude must be given on this account.

Metals at Absolute Zero.—Prof. Dien has recently published some interesting observations on the behavior of metals at the absolute zero of temperature. The infinite electrical conductivity of metals at absolute zero, which has been rendered very probable by the work of Kamerlingh Onnes, is explained if we assume that the distribution of molecules at the lowest temperatures is perfectly regular, so that the displacement of electrons along certain lines encounters no resistance. By increasing the temperature, the molecules are set in a state of thermal agitation and the free path of the electrons is reduced; whence the electric conductivity is reduced also. It appears probable that temperature variation affects only the mean free path and not the number of electrons nor their mean velocity.

Increasing the Yield of Gasoline from Petroleum by Use of Catalytic Nickel.—An English company is securing a very large yield of gasoline from petroleum by catalytic hydrogenation. The method is practically the same as that recently applied in the conversion of liquid fats to a solid form or to solid fatty acids with a higher value. A tall still with a conical bottom receives a steady feed of petroleum and hydrogen gas under pressure. This mixture enters at the bottom and passes over finely divided nickel which catalytically brings about a reaction between the hydrogen and oil. Gasoline is formed which passes off as a vapor at the temperature of the still, while the heavier hydrocarbons formed fall back into the catalyst and react with hydrogen. Finally a tarry residue must be removed and the nickel regenerated. The issuing gases pass into a cooling chamber where the gasoline is condensed. The hydrogen unused up to that point is forced back and passed through the still once more. The efficiency of the process is very high.

The Colors of Odoriferous Plants.—Messrs. Schubler and Kochler have published the results of some very interesting observations they have undertaken on the relations between the colors and odors of various flowers. They have analyzed more than 4,200 plants, and they find that: (1) white is the most common color for flowers, and (2) that red, yellow and blue are more general than violet, green, orange and brown. The different odoriferous species divide themselves among the different colors in the following manner:

Color of Flowers.	Number of Species Examined.	Number of Species Having Odors.
White	1,194	187
Red	933	84
Yellow	950	77
Blue	594	31
Violet	308	13
Green	153	24
Orange	50	3
Brown	18	1
Total	4,200	420

As will be seen, the number of plants possessing odors is only one tenth the total number of species. We also see that in proportion, it is among the white flowers and then the red that we meet the greatest number of odorous plants.

Aeronautics

A New Aeroplane Stabilizer.—W. E. Verclaire, of Chicago, Ill., in a patent, No. 1,093,746, provides for tilting the planes in which the propellers rotate to agree with the tilting of the stabilizing planes in order to facilitate the control of the aeroplane.

A Gas Container that Forms a Parachute.—Albert A. Callicotte, of North Yakima, Wash., has patented, No. 1,092,973, an airship in which the gas container is shaped as a parachute. Horizontal and vertical tubes are provided in which are arranged the propelling and elevating means.

The Aeroplane and the North Pole.—The report comes from Berlin that Capt. Roald Amundsen has completed a course of training as an air pilot at Johannisthal. He will take with him two aeroplanes on his polar expedition, hoping to reach the pole by air after travel by sea becomes impossible.

Hirth's Flying Machine.—Hellmuth Hirth, the well-known German aviator, has secured patent No. 1,094,893 for a flying machine, the different parts of which are arranged so that the lifting power may be rapidly and easily adapted to the load carried, and the speed of flight to the local circumstances, for instance, those present in landing.

A Tax on Aviators.—An entry and circulation tax upon aviators in Germany is not likely to be favored in aeronautic circles. It is now being considered by the Foreign Office, and applies to all outside aeroplane pilots with their machines, somewhat like the rules which exist in Alsace-Lorraine as concerns automobiles. The tax will be $12.50 and even $25 per pilot, regardless of whether he enters by railroad or by actual flight.

An Aeroplane Review.—During the visit of the English sovereigns to Paris, one of the interesting events was the army review held at the Vincennes military grounds, and on this occasion aeroplanes were out in force. During the maneuvers pilots made a sham attack upon the airship "Montgolfier" which is the "Clement-Bayard VI." rebaptized, and as the airship itself is remarkably easy to handle, such an attack brought out the pilots' skill, and showed what we might expect in real war. The whole maneuver was a great success and is a very novel performance with the two kinds of aircraft. Farman biplanes were used entirely in this case, most of them equipped with De Dion motors.

The Russian Programme.—According to latest news about military aircraft matters in Russia, it appears that the war department has made a number of changes in the programme which is proposed for construction of new aeroplanes. The new programme in fact calls for building 100 aeroplanes of the Deperdussin, and the same number of the Morane type, as well as 40 Farman aeroplanes, making 240 flyers in all. On the other hand, the number of Sikorsky aeroplanes which are to be built by the Russo-Baltic establishment is considerably reduced, for at first it was proposed to build about 100 flyers of this type, but the present programme calls for only 45. Of this number, 25 will be biplanes, 13 monoplanes, and the remainder will be used as teaching apparatus without motors.

Aviation in Russia.—The general assembly of the committee of the Russian aerial fleet was held not long since, presided over by Grand Duke Alex. Michailovitch, and it was decided, first, to organize corps of aerial militia which will add volunteer aeroplane pilots in order to reinforce the army and navy fleets; second, to establish military aviation stations provided with strong electric searchlights; third, to form a corps of aeroplanes which are to act as a reserve in order to supply the main fleet with all that is necessary in time of war. As regards Russian aeroplane events, we note that Prince Abamalek has offered a prize of 10,000 roubles for a successful flight from Sebastopol to St. Petersburg during May or June, the trip to be made within 24 hours. Although this time may appear short, it is claimed that during the good weather that prevails at this season, the trip can be made without undue difficulty in that length of time.

Armored Aeroplanes for France.—A fleet of armored aeroplanes is being prepared for the use of the French army, according to recent statements made by the Minister of War, and it is designed to serve mainly for scouting purposes. Before long a fleet of the new aeroplanes is to start from the Chalais-Meudon establishment for the Mailly camp where the final trials are to take place. Such flyers are biplanes and have two places, being built according to Comm. Dorand's designs. The armored body or fuselage holds pilot and passenger who are protected by a 2½-millimeter steel plating, and it is claimed that it cannot be penetrated farther than 2,500 feet. In front is the motor of 85 horse-power size, and the speed will be about 60 miles an hour. According to a well-known expert, the present flyers are the only armored aeroplanes that have been able to satisfy the requirements for this class of flyer. Six aeroplanes will make up the present fleet, and they will be manned by well-known pilot officers.

One of the screw type guy anchors.

Making fast to the shifted track.

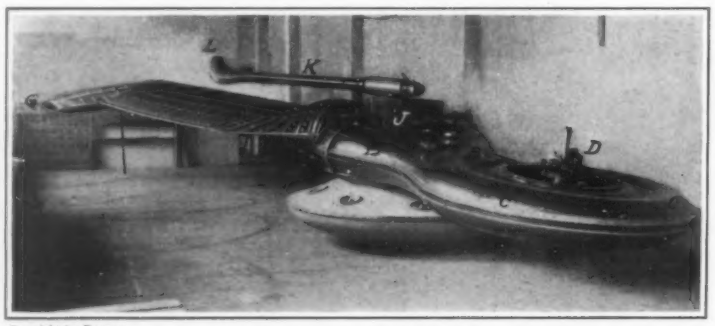
The track restored to the original position.

Hauling a Flood-swept Railroad Back to Line

SECTION gangs on the Louisville and Nashville Railroad last spring performed the unique feat of hauling back into place six miles of railroad track that had been washed away by the floods. For about three miles on either side of the Wabash River the high water had not only shifted the tracks and ties, but in some places had upended them against the telegraph poles, so that they resembled a grotesque picket fence that had been hit by a cyclone.

The method used in working the track into position while the waters were still running over the right of way was as follows: A dozen 12-inch guy anchors were rushed to the scene of trouble, the sort that can be screwed into the ground, and offer a secure anchorage against heavy strains. With the water running from a foot and a half to three feet deep, these anchors were screwed into position along the shifted railroad tracks, upstream from the right of way. A block and tackle was passed through the eye of each anchor and around the railroad track and then twenty or thirty laborers would tug on the fall line until the section was slowly worked into position. It was then staked down to prevent further shifting, the anchors were unscrewed and the operation was repeated. Not only the dead weight of tracks and ties, but the resistance of the current made a terrific strain on the devices thus brought into unexpected use, but they proved to be decidedly effective, so that about two thousand feet of track was relaid every day, as against six to seven hundred feet by previous methods.

The photographs show the details of the operation and indicate the unusual difficulties under which the section hands were operating.



Copyright by Branger

Freak flying machine built on the principle of the boomerang.

Electric Towing Locomotives for Panama Canal Locks

THE first lot of electric towing locomotives for hauling vessels through the locks of the Panama Canal are now being received at the Isthmus. In all, forty of these "electric mules" are being built by the General Electric Company for this purpose. The machines weigh 82,500 pounds; measure 32 feet 2½ inches long by 8 feet wide by 9 feet 3 inches the greatest height over the cabs; have an available tractive effort as high as 47,500 pounds and a windlass rope pull of 25,000 pounds, and four of them, two on each side, will ordinarily propel steamships through the locks. Sometimes six engines will be needed to handle extra large vessels; in every case two astern, acting as a brake on the ship's movements, will give direction to her course. No vessel will be allowed to enter the locks and go through on her own power.

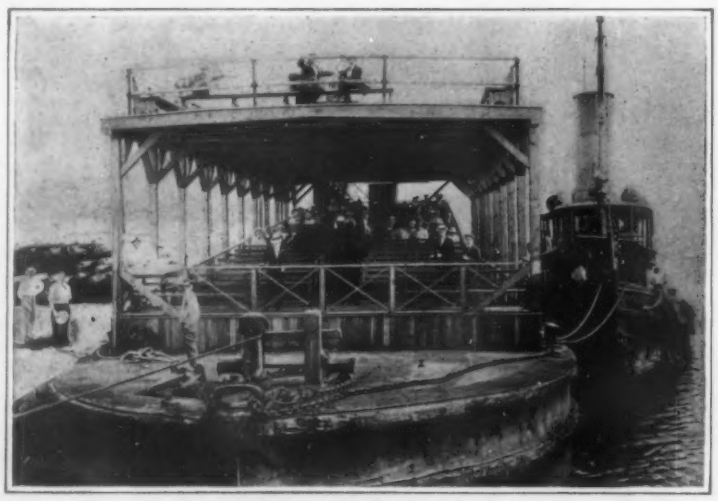
The locomotive is propelled by means of a rack rail while towing and while going up or down the steep grades from one level to another at a speed of 2 miles per hour. While running idle or on return tracks, the speed is changed to 5 miles per hour, and the machine is propelled by the regular traction method, the rack pinion being entirely released. This change is effected by manually-operated clutches located in the gear mechanism in connection with a lever in each cab similar to a steam locomotive.

The locomotive is driven by two 75 horse-power totally inclosed motors of the mill type, one being direct connected through reduction gearing to each axle. Three-phase, 25-cycle, 220-volt current is used, and is collected by contact plows. The motor and traction gearing is mounted on a common base-plate, which in turn is mounted on a driving axle and spring suspended to the locomotive frame the same as in regular railway practice.

In the center of the locomotive is located a vertical windlass with drum, the capacity of which is 800 feet of 1-inch steel hawser cable. The windlass, with its driving motors and gearing, is mounted on a solid base-plate, and is likewise independent of the movement of the locomotive frame. The cable drum extends above the locomotive cover and has a floating guard placed around it to retain the cable while coiling loose.

The windlass cable is handled by two 20 horse-power motors, also totally inclosed and of the mill type. One is geared for a rope speed of 12 feet per minute at a pull up to 25,000 pounds at 2 foot radius, and its function is to adjust the position of the ship for anchor or while being towed through the locks. The other motor is geared for a rope speed of 200 feet per minute at 2-foot radius, and its duty is to take up slack or pay out cable or wind in any part of the entire length of cable as may be required. The cable drum is driven through a friction device which can be set at any desired value from zero up to the full capacity of the motor.

One of the towing locomotives for the Panama Canal locks.



Sight-seeing barge for the Panama Canal.

A "Boomerang" Flying Machine

TWO French engineers, A. Papin and D. Pouilly, are responsible for a new departure in aeronautics—a departure that has not yet departed from the solid earth. They explain that in designing their machine they had before them mainly three purposes: To provide a device which could rise from the ground without preliminary "run," and which could similarly alight on a selected spot; to furnish a machine that could at will either advance through the air or be held stationary; to provide for a slow descent in case of failure to the motor.

The apparatus is designed on the principle of the boomerang, or, to use another illustration, of the maple seed, which represents a natural example of a screw propeller revolving about an imaginary axle and capable of assuming different inclinations. The fall of the maple seed is familiar to all, how it slowly descends, revolving about its axis as it does so. If the direction of its rotation were reversed by the application of suitable power, the seed would rise instead of falling.

Our illustration shows the new "flying machine." It constitutes a huge single blade screw propeller with a spread of 178 feet. The blade *A* and the central body *B* are hollow, and through them a stream of air is blown by a fan *C*, driven by a motor *D*. The motor is an 80 horse-power, nine-cylinder gasoline engine, and is manipulated by compressed air controls from the car, which does not participate in the rotation of the rest of the machine. The blast of air escaping from the curved tip of the propeller at *G* causes it to revolve by impulse reaction. The car *J* is mounted on ball-bearings. Over it is situated a hollow antenna *K*, the tip of which is curved in the direction opposite to that of the tip of the propeller blade. Through this hollow antenna a blast of air is also blown, issuing at the nozzle *L*.

The new device is, without doubt, interesting—from a psychological point of view. But—will it fly? Perhaps this is a secondary consideration.

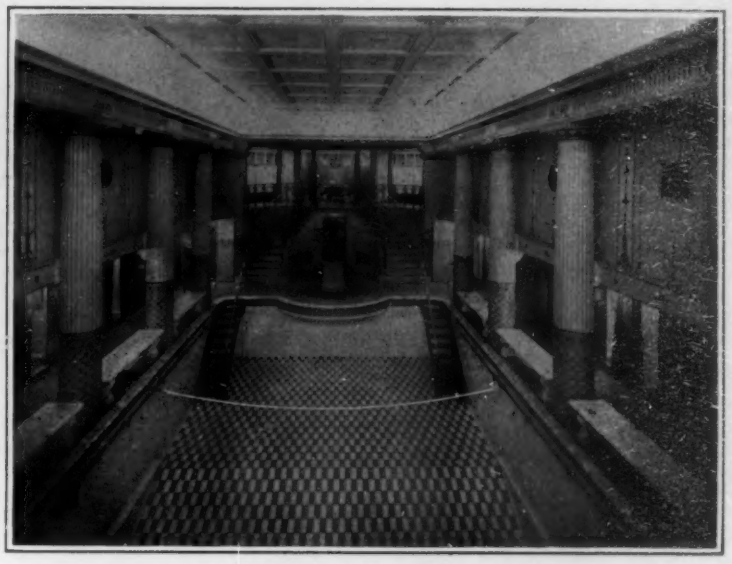
Sight-seeing Barge for the Canal

THE greatest sight-seeing conveyance for public use is the passenger carrying barge fitted up to make trips through the Panama Canal. Its foundation is a steel dump barge, brought to the Isthmus in 1909, which is 154 feet long, with a 32-foot beam, 10 foot 7 inch depth. It has a gross displacement of 500 tons.

Like the familiar sight-seeing automobiles, the seats are arranged in tiers, gradually descending from a height of 8 feet 9 inches in the rear to 2 feet at the forward end, and there is also standing room for the passengers on the roof.

The Paper Used by the Government printing office each year requires approximately 125 million pounds of rag pulp and 490 million pounds of wood pulp.

The main saloon, which is entirely free from columns.



A notable feature is the Pompeiian swimming pool.

The World's Largest Steamship

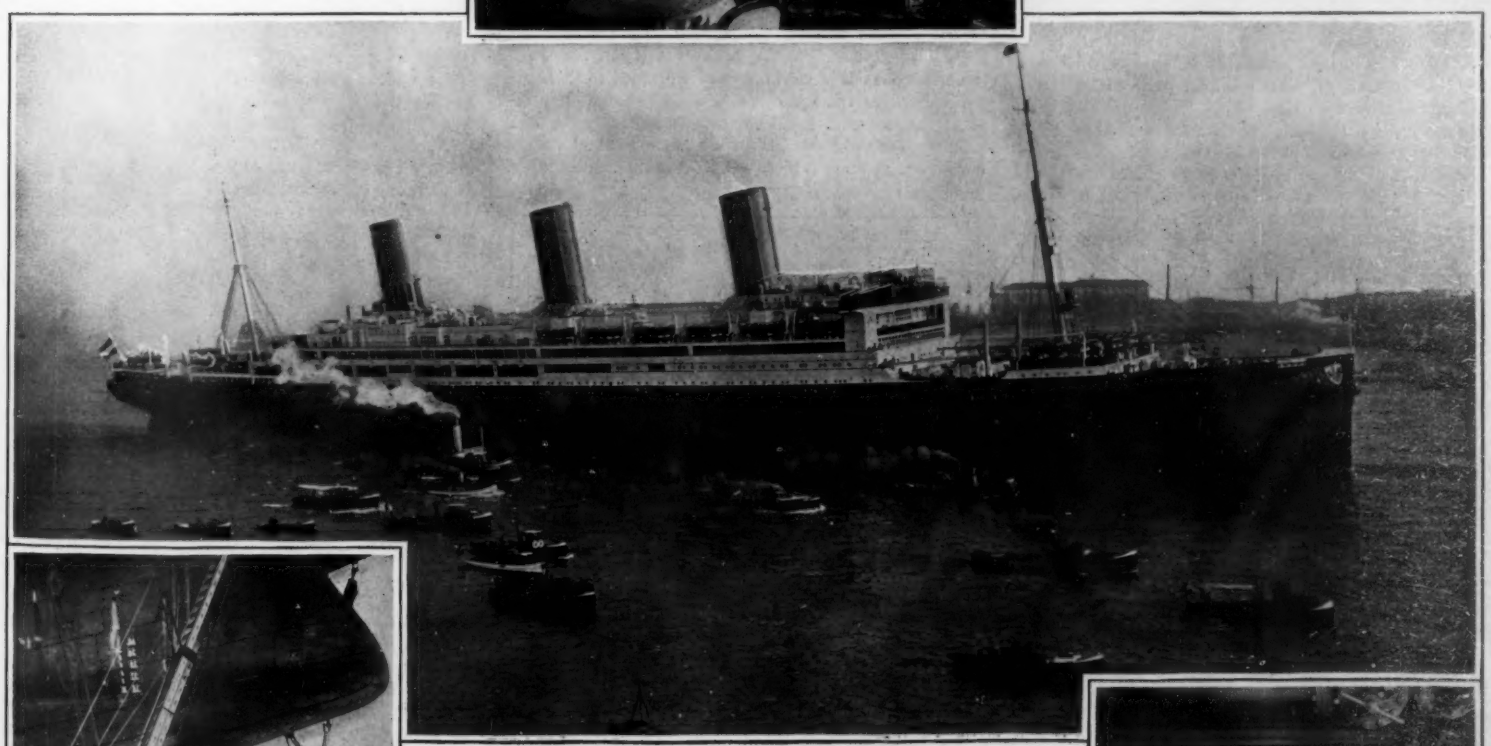
Maiden Voyage of the Steamship "Vaterland," to the Port of New York

WITH the launching of each "largest" steamship it was customary, a few years ago, to say of her that the limit of size had been reached, and that in future there would surely be a return to more moderate dimensions. To-day, we hear no such prognostications; for the dimensions so far from diminishing, give promise rather of increasing. It was less than one year ago that there steamed into the port of New York the "Imperator" of the Hamburg-American Line—the first ship to exceed a length of 900 feet, her length on deck being 909 feet, and her displacement 52,000 tons. This week sees the advent of the "Vaterland" of the same company, a huge ship, which exceeds the "Imperator" in length by 41 feet, in beam by 2 feet, and in displacement by no less than 6,000 tons.

The "Vaterland," which was built at the yards of Blohm & Voss, Hamburg, is 950 feet in length, 100 feet in beam, and she displaces 58,000 tons. We are informed by the company that during a trial cruise of over two days' duration she averaged a speed of 25.8 knots, her turbines developing 90,000 horse-power. In view of the fact that she was announced as a 23-knot ship, this is certainly a most surprising result, although the great work which has been done by her builders in the construction of high-speed German armored cruisers propelled by similar motive power, all of which greatly exceeded their contract speed, should have prepared the public for very fine steaming results in this vessel. Thus, the "Von der Tann," designed for 25 knots, made on a recent trial 28.1 knots; the "Moltke" and "Goeben," designed for 27 knots, on recent runs made, respectively, 28.7 and 28.6 knots. The motive power of the "Vaterland" is broadly similar to that of the cruisers, consisting of four turbines driving four propellers.

As compared with the "Imperator," which was built at the Vulcan Works, the "Vaterland," to the eye of any but the expert, looks to be practically identical, her increase in length of 41 feet being scarcely perceptible on a ship of such great dimensions. Her under-water form, however, and the construction of the hull at the stern are quite different, the "Vaterland" having what is known as a cruiser stern, with a balanced rudder which is entirely below the waterline. The form of the

The dining room seating eight hundred people.



The "Vaterland" leaving Hamburg for her trial trip.
Length, 950 feet; beam, 100 feet; displacement, 58,000 tons.

Cruiser stern and balanced rudder.

A stretch of deck, showing wind screens.

"Vaterland" also differs greatly from that of the "Imperator," the successive water planes aft being fuller than those of the earlier ship. We understand that the changes in her model, as compared with the "Imperator," had much to do with the high speed which she achieved on her trial. A feature which adds to the appearance of the ship is the absence of the monster eagle which is carried at the bow of the "Imperator." An eagle makes an appropriate figurehead on a clipper-bowed ship; but it is inappropriate and quite inharmonious when placed at the top of a straight stemhead such as characterizes the modern transatlantic liner. The shield and scroll work of the "Vaterland" are in better taste.

The "Vaterland" is constructed with both longitudinal and transverse bulkheads, the longitudinal bulkheads forming the inner walls of the coal bunkers, and serving as an inner skin. All the walls of the passenger decks have been coated with special fireproof material. The bulkheads are of unusual stiffness, and the openings in them, where they pass through the passenger accommodation, are closed by fireproof glass doors, thirty-nine in number, which will withstand a temperature of 1,000 degrees. The staircases are so encased with fireproof material that each forms a fireproof inclosure. A special fire department, composed of trained fire fighters, devotes its entire attention to fire protection. It occupies a special cabin, where all the fire alarm signaling devices are centered. There are more than 450 fire announcers throughout the ship, which would instantly indicate a dangerous rise of temperature. A complete system of automatic fire sprinklers, comprising 800 water jets, is distributed throughout the crew's quarters. A special fire fighting device employing chemicals in place of steam is operated by the firemen. There is also a complete system of fire hose and pumps. The fire fighting installation fulfills the strictest rules laid down by the German building and police authorities. The "Vaterland" carries eighty-four lifeboats, including two motor lifeboats, which more than accommodate all on board.

The several cabins of the "Vaterland" have been designed by the leading decorators of Europe; and the great liner with its paintings, sculptures, and decorations affords an interesting study of the decorative arts. The grand dining saloon, which seats 800 guests, is finished in white and gold, its ceiling being supported by Ionic columns. In contrast to this the Ritz Carlton is carried out in mahogany and walnut, decorated with heavy garlands in bronze. The smoking-room is paneled in Flemish oak in low tones, while the main lounge, which may be converted into a ballroom, is decorated in warm red tones. The art treasures include paintings by old Italian masters as well as work of many notable contemporary artists. On the main staircase hang two landscapes by the Venetian artist, Giovanna Battista Pittoni (1690-1767). Four large canvases by Lairesse adorn the main saloon; and a portrait of King Ludwig of Bavaria, by Baumgartner, will be found in the ladies' saloon. The smoking-room is enriched by two marine studies by Prof. Schnars-Alguist, while a great panoramic study, by Kolmsperger, adorns the cupola of the dining-room.

The Death of Paul Louis Heroult

A PRIVATE cable to students of the Massachusetts Institute of Technology announces the death in Paris on Saturday of Paul Louis Toussaint Heroult, whose name will ever be connected with aluminium and the electric furnace. The name is familiar in Boston in that his son Paul was a student at the Massachusetts Institute of Technology from 1910 till 1912, going home at the end of his sophomore year for his service in the army. He was particularly active in athletics, being on the tug-of war team, second in the pole vault and one of the wrestlers.

Heroult *pere* was born at Thury-Harcourt, and had his boyhood schooling about equally in England and France. He went to the Lyceum at Caen and later to St. Barbe, Paris. In 1882 he attended the School of Mines in Paris, and the next year took his military service in the army. On finishing this he went with a metallurgical firm, and giving his attention to aluminium, in 1886, two years thereafter, he obtained a patent for the production of this metal electrolytically. On his discoveries are based the improvements in methods that brought the price of the metal from $20 a pound in 1884 to about 50 cents in 1901.

The more recent achievements of Heroult have been in the line of the electric furnace for steel, aluminium and other metals. His principal work here was the introduction of two electrodes into the melting-pot, so that the ore received the full effect of the heat and the furnace was little more than a container. A later improvement consisted of a third electrode, which was in the nature of a starter and which burned away when the furnace rose to its proper heat. For his furnace he received in January, 1904, the medal of the French Society for the Encouragement of National Industries. The Heroult furnace is in extended use to-day in many places, while for Canada he made a special investigation with the nature of the local ores in view.

Do Plants Sleep?

By Maud DeWitt Pearl

WE ordinarily think of the ability to sleep as something belonging exclusively to the animal kingdom. Whether plants likewise enjoy a daily period of rest has recently been studied by a distinguished Indian botanist, Prof. Bose, of Presidency College, Calcutta, India. He worked with the sensitive plant, *Mimosa pudica*. An electrical apparatus was constructed, which, at regular intervals throughout the day and night, gave a slight but constant shock to the plant. When the plant responded to this stimulus it drooped its leaves and stems. Then, after a period of quiescence, it gradually returned to its original condition. The degree of response to the electric current and recovery to the normal condition were recorded upon a smoked glass plate by means of a tracer attached to the apparatus, so that an hourly record was obtained,

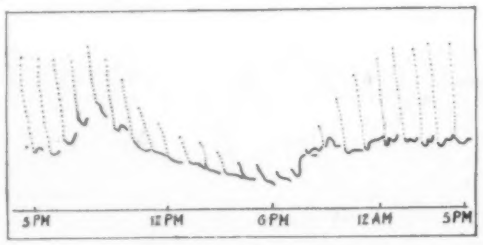


Fig. 1.—Diagram showing response of Mimosa to stimulation during a period of twenty-four hours.

for many days and nights, of the state of the "motor-excitability," as Prof. Bose terms it, of the plant. The results which were obtained show that Mimosa is in the Land of Nod, regularly, every day. What is true of Mimosa is undoubtedly true for plants in general.

If it had not been for Prof. Bose's experiments, however, no one would have suspected that plants are guilty of disobeying the old adage of "early to bed and early to rise," etc. But the experiments show Mimosa to be a very late sleeper. At nine o'clock in the morning the plant is practically unresponsive when stimulated by the electric current. From this time on, however, there is a gradual awakening until at noon the maximum response is reached. This continues until about five o'clock in the afternoon, when the fluctuation toward the opposite condition sets in. The motor-excitability gradually diminishes until the minimum state is reached at about nine o'clock the following morning.

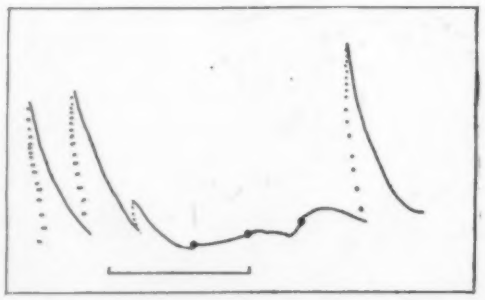


Fig. 2.—Response when subjected to sudden cold.

This variation of the motor-excitability of the plant is due to the combined effect of light, temperature, and moisture. During the night the temperature is lower, the stimulating effect of light is withdrawn, and the plant becomes more turgid, owing to its not giving off so much moisture. Since the effect of these factors upon the plant is cumulative and at the same time there is a lag in the response of the plant to them, we have the explanation of why Mimosa is in a state of lethargy so late in the morning. Likewise, why the plant is in the opposite condition late in the afternoon when night is fast approaching.

The accompanying drawing, Fig. 1, shows the state of excitability of Mimosa during a period of twenty-four hours when stimulated regularly by the electric current. The diagram is read from left to right. The uneven base line is due to the regular leaf movements which the plant exhibits daily and is not related to the response of Mimosa to the electric current. The downward curve represents the gradual recovery from the stimulus. It will be noted that the plant is markedly excitable from 12 A. M. up to about 9 P. M. From this time on there is a gradual decrease in response to stimulation until late in the morning, when the plant shows no excitability whatever. After this time the recovery is quite rapid up to 12 A. M., when the height of excitability is reached.

Fig. 2 shows the amount of response to the electric current when subjected to sudden cold. The dotted upward lines indicate the degree of response to the stimulus, the smooth downward lines, the recovery. It will be noticed that after the plant is exposed to sudden cold the first response to the current is much lessened, and the second and third stimulation produce no effect whatever. The ordinary temperature is then resumed, but the plant still exhibits the after-effects of the cold.

Setting a Watch

By Frederick E. Ward

THE accurate time signals sent out by wireless at noon and at 10 P. M. from the Government station at Radio, Va., have stimulated the interest of those who are equipped with receiving apparatus in keeping their watches closely regulated and set.

Watch movements as good as the 17 jewel grade, and costing about $15, may, by careful adjustment of the regulator, be made to keep time to within thirty seconds per month; so that, if a curve be plotted on cross-section paper showing the error of a watch, each time it is checked by the wireless signal, it is possible to estimate closely what the error should be at any given time.

Since, however, an exact adjustment of the regulator is impossible and the error gradually increases until it becomes inconveniently large, it is often desirable to reset the hands. The usual method of doing this, by stopping the balance wheel with a toothpick and letting it go at the right moment, is inconvenient unless there be another time-piece at hand and is also open to other objections.

The author has discovered a method of bringing the error back to zero, or of setting a watch accurately without disturbing it in any way. If the chain or fob be removed, and the watch be hung up by its bow on a hook or nail driven in the wall, so that it hangs free, it will be found to swing itself slightly, pendulum fashion, by reason of the motion of the parts of the escapement. The effect of this swinging on the running of the watch varies between individual watches and depends on the weight of the case and on its dimensions. As a rule, it will be found that a watch gains about two seconds per hour, though some of them show a loss, instead. The exact amount must be found by trial, say, by hanging up the watch for ten hours and checking it against the wireless signal. Once this value is known it is obvious how it may be used to advantage. If the watch *gains* when hung up, the regulator should be adjusted so as to make it run a trifle *slow*. Then when the accumulated error becomes inconveniently large, the watch may be hung up on the hook, say at night, for the right number of hours to bring its second-hand ahead to the correct position.

Should a watch be found of such weight and dimensions as to neither gain nor lose when hanging as described, it can be made to respond by hooking on a piece of metal at the base of the stem, thus raising the center of oscillation of the swinging mass. For the same reason a hunting-case watch has a different rate when hung with its case open from the one when the case is closed. It is an added convenience to know both these rates, since sometimes one is positive and the other negative, thus enabling one to set the watch either forward or backward at will.

Our Front-cover Illustration

AS evidence that the giant ocean liner is profitable, it should be noted that there are five vessels of 900 feet length and over building or under construction. These are the "Vaterland," 950 feet; "Imperator," 909 feet; a sister to the "Vaterland" building at Hamburg; the "Aquitania," 900 feet, which will reach New York in June; and the "Britannic," 900 feet, shown on our cover, due here next Autumn.

The Current Supplement

IN this week's issue, No. 2003, of the SCIENTIFIC AMERICAN SUPPLEMENT, E. R. Matthews contributes an illustrated article on the effects of wave-action upon harbor breakwaters and piers.—E. H. Ross writes on Housefflies and Disease.—H. J. Spinden tells us the story of an interesting chapter of ancient American history.—Bashford Dean writes on the habits of fishes, as illustrated by exhibits in the American Museum of Natural History.—A paper read by W. A. Hargreaves before the Society of Chemical Industry on "Blasting Gelatines" is reported in full.—A timely topic discussed is that of disease danger in the invasion of Mexico.—The use of trees as windbreaks for farms is illustrated and described.—A chart prepared by C. H. Clark shows at a glance the strength of shafting needed to transmit a given horse-power at different speeds.

The Fallacy of the Combined Aeroplane and Dirigible Balloon

By R. H. Upson

THE reason for proposing a combination of balloon and aeroplane is not hard to find. Probably the inventor reasons something like this: "The aeroplane is inexpensive, compact and speedy; but it is unsafe, and will not carry much weight. The dirigible is big, clumsy, expensive and slow; but it is safe, and it will carry a comparatively large weight. Let us combine the two principles in such a way as to get the advantages of each without the disadvantages. Let us attach to an aeroplane a balloon bag which is large enough to carry part of the weight and let the machine down slowly in case of accident, but will not be so big and offer such resistance to speed as a regular dirigible which has to lift all of the weight unassisted. Then the aeroplane will also be big enough to carry the machine safely to the ground in case the balloon explodes."

This is what is generally meant by a "Combined Aeroplane and Dirigible"; that is, a combination, each unit of which can carry a considerable part or all of the weight. Aeroplane surfaces on dirigibles for steering purposes, or as a substitute for ballast, are in an entirely different class and are practically necessary in some form. Then there is the entirely feasible, though perhaps not practicable, method of *balancing* an aeroplane by means of a balloon; these forms will be considered outside of the present sphere of discussion.

The arguments given above for the combination machine might seem very reasonable. They are. The only trouble is that it doesn't work out that way. The argument is all right, but the premises are wrong. Most of the fallacies in such a scheme arise from disregarding one or more of the following laws:

1. There is no object in combining two *different* methods for attaining a given result unless some added advantage peculiar to such a combination is gained. Thus you wouldn't ordinarily hitch a gas engine and a steam engine in tandem to drive a dynamo, but would select the most efficient unit for that particular work, and use it exclusively. On the other hand, the combination of a reciprocating engine with a turbine is often better than either one alone because, although not so efficient at high pressures, the turbine can get energy out of the exhaust steam which would otherwise go to waste.

2. The volume and hence the lift of a balloon varies as the cube of its outside dimensions. Much trouble is caused by a misconception of the size necessary to lift any considerable weight. There *are* balloons which will carry a large weight but they are all very much bigger than any aeroplane ever attempted. A dirigible 260 feet long by 50 feet in diameter will lift a total of 26,000 pounds when inflated with hydrogen. A balloon one tenth these dimensions would be 26 feet long by 5 feet in diameter, comparable in size to the ordinary aeroplane; yet it would barely lift itself, a total of 26 pounds.

3. For small sizes, the resistance and weight of a balloon vary as the square of its outside dimensions.

4. It takes exactly as big a balloon to keep a given weight from falling as it does to lift it. As a close corollary to this, we have that it takes nearly as much gas to let a weight down easily as it does to lift it.

5. The lift of an aeroplane varies as the square of the dimensions while its weight and resistance (for structural reasons) must vary by a little more than the square. Furthermore, the efficiency of a surface is very much impaired by extending or multiplying it from front to rear, which is just the opposite to the case of the dirigible. (In spite of this, the aeroplane can probably be developed considerably above its present size.) The efficiency of an aeroplane decreases slightly with increase in size. Not so with the dirigible. It is fundamentally and always will be a large machine. The results to be gained by even a moderate increase in size are almost inconceivable at first; but it is founded on strict elementary laws which cannot be ignored any more than the existence of gravitation.

As an actual example, let us figure out roughly how much we can improve an ordinary Wright aeroplane by the addition of a cigar-shaped balloon which will lift half the weight. I think we may take the performance of the aeroplane alone about as follows: Horse-power, 30; speed, 40 miles per hour; resistance (thrust) 180 pounds; efficiency of power unit, 64 per cent; total weight with fuel and 2 passengers, 1,000 pounds.

Take away half the supporting surface, which might reduce the weight to 800 pounds, and the resistance to 120 pounds, for the same speed. A balloon 60 feet long by 18 feet diameter would have a total lift of 780 pounds when fully inflated with hydrogen. Its weight with suspension cords, framing and accessories would be in the neighborhood of 380 pounds, thus leaving 400 pounds for lift, or half the weight of the reduced size aeroplane. Its resistance, with extra bracing, etc., would be close to 300 pounds at the 40 mile speed. The speed of the combination would be cut down in consequence to about 26 miles per hour, and the lift of the aeroplane to 170 pounds. We lose, in this way, 230 pounds of lift that we had counted on from the aeroplane. It means that instead of cutting down its size to meet the new conditions, *we should have actually increased it* by 3 or 4 times its original area. After making these corrections, we get final results something as follows: Speed, 20 miles per hour; total weight, 1,600 pounds; lift of gas-bag, 800 pounds; lift of aeroplane, 800 pounds.

We have reduced our speed to one half that of the original aeroplane. We have a machine which is clumsier, more expensive and slightly less speedy than a regular dirigible of equal power and passenger carrying capacity. Certainly such a sacrifice should be accompanied by some very great advantage, but where is it? Take the matter of safety. Suppose the machine were to lose headway and fall vertically. The area resisting the descent consists of the superposed aeroplane surfaces and the horizontal surface of the balloon, which are about 1,500 and 900 respectively. The most favorable possible calculation would give a speed of descent of 20 feet per second, hardly a safe velocity at which to strike the earth.

Instead of taking the horse-power the same in the above example, we could have assumed equal speeds for the two machines and increased the power to suit; but the results in the latter case are equally significant and still less effective in producing safety.

The scheme of making the balloon bag itself in the form of an aeroplane seems still less promising. If the balloon were distorted enough to give it any efficiency as an aeroplane surface its weight and resistance would be prohibitive. I shall touch on this a little more fully in the paper on double balloons.

It *might* be possible to provide a regular dirigible with enough aeroplane surface to carry it safely to earth in case of an explosion; but there is no need for it. Such an accident very seldom occurs, and it is easily prevented by taking proper precautions. Such a large surface would be very heavy, and offer much resistance even when folded up. Then consider, for example, the difficulty of constructing and managing a set of aeroplanes big enough to carry a large dirigible, which would be suddenly called upon in an emergency to support 15 to 20 tons. Such an accident is much better taken care of by prevention in the first place. As a last resort, I would suggest individual parachutes for the passengers.

Changes in the Patent Office Rules

ACTING with the approval of the Secretary of the Interior, the following changes are made in the Rules of Practice in the Patent Office to take effect May 13th, 1914:

Rule 101 is amended to read:

101. Upon the institution and declaration of the interference, as provided in Rule 102, the examiner of interferences will take jurisdiction of the same, which will then become a contested case; but the law examiner will determine the motions mentioned in Rule 122, as therein provided.

Rule 109 is canceled and the following substituted in its place:

109. An applicant involved in an interference may, at any time within thirty days after the preliminary statements (referred to in Rule 110) of the parties have been received and approved, on motion duly made, as provided by Rule 153, file an amendment to this application containing any claims which, in his opinion, should be made the basis of interference between himself and any of the other parties. Such motion must be accompanied by the proposed amendment, and when in proper form will be transmitted by the examiner of interferences to the law examiner for his determination. On the admission of such amendment, and the adoption of the claims by the other parties within a time specified by the law examiner, the primary examiner will re-declare the interference, or will declare such other interferences as may be necessary to include the said claims. New preliminary statements will be received as to the added claims, but motions for dissolution will not be transmitted in regard thereto where the questions raised could have been disposed of in connection with the admission of the claims. Amendments to the specification will not be received during the pendency of the interference, without the consent of the Commissioner, except as provided herein, and in Rules 106 and 107.

Rule 122 is amended to read:

122. Motions to dissolve an interference (1) upon the ground that there has been such informality in declaring the same as will preclude a proper determination of the question of priority of invention, or (2) which deny the patentability of an applicant's claim, or (3) which deny his right to make the claim, or (4) which allege that counts of the issue have different meanings in the cases of different parties, should contain a full statement of the grounds relied upon, and should, if possible, be made not later than the thirtieth day after the statements of the parties have been received and approved. Such motions, and all motions of a similar character, should be accompanied by a motion to transmit the same to the law examiner, and such motion to transmit should be noticed for hearing upon a day certain before the examiner of interferences. When in proper form the motion presented will be transmitted by the examiner of interferences, with the files and papers, to the law examiner for his determination, who will thereupon fix a day certain when the said motion will be heard before him upon the merits, and give notice thereof to all the parties. If a stay of proceedings is desired, a motion therefor should accompany the motion for transmission.

When the motion has been decided by the law examiner the files and papers, with his decision, will be sent at once to the docket clerk.

Motions to shift the burden of proof should be made before, and will be determined by, the examiner of interferences. No appeal from the decision on such motions will be entertained, but the matter may be reviewed on appeal from the final decision upon the question of priority of invention.

Rule 124 becomes:

124. Where, on motion for dissolution, the law examiner renders an adverse decision upon the merits of a party's case, as when he holds that the issue is not patentable or that a party has no right to make a claim, or that the counts of the issue have different meanings in the cases of different parties, he shall fix a limit of appeal not less than twenty days from the date of his decision. Appeal lies to the Examiners-in-Chief in the first instance and will be heard *inter partes*. If the appeal is not taken within the time fixed, it will not be entertained, except by permission of the Commissioner.

No appeal will be permitted from a decision rendered upon motion for dissolution affirming the patentability of a claim, or the applicant's right to make the same, or the identity of meaning of counts in the cases of different parties.

Appeals may be taken directly to the Commissioner, except in the cases provided for in the preceding portions of this rule, from decisions on such motions as, in his judgment, should be appealable.

Rule 128 is canceled and the following substituted in lieu thereof:

128. If, during the pendency of an interference, a reference be found, the primary examiner shall call the attention of the law examiner thereto, and the latter may request the suspension of the interference until the final determination of the pertinency and effect of the reference, and the interference shall then be dissolved or continued as the result of such determination. The consideration of such reference shall be *inter partes* and before the law examiner.

Looping the Loop

A Pilot's and a Passenger's Impressions

LOUIS NOEL'S impressions of "looping the loop" in a flying machine are thus recorded in *Flight:* "There are no words in which to express the sensation. As it is, the ordinary flight is quite exhilarating, but this new stunt quite exceeds everything in the world; in fact, in a word it is super-human. When once you have done it you feel you must repeat it again and again; you are so intoxicated with the wonderful sensation. You start off, and rise to a height of between 600 feet and 700 feet, and then you can begin the joke absolutely without danger. After executing a gentle *vol piqué* you pull the lever back, and the 'bus leaps with tremendous speed upward—which it loses at the zenith of the loop. At this moment you are completely isolated from the earth and you can see nothing but the planes. Then it is that an incomprehensible sensation runs through you at being absolutely alone, suspended by an invisible string amid air. I assure you it is a unique position; nothing to fear—only happiness. All this of course (unfortunately) is done and finished in a second or so, and, after diving again, you have the first glimpse of the earth under you and you can only regret that the looping is over. There is just one thing to consider, however; I think that if I 'loop' often I shall lose that wonderful feeling."

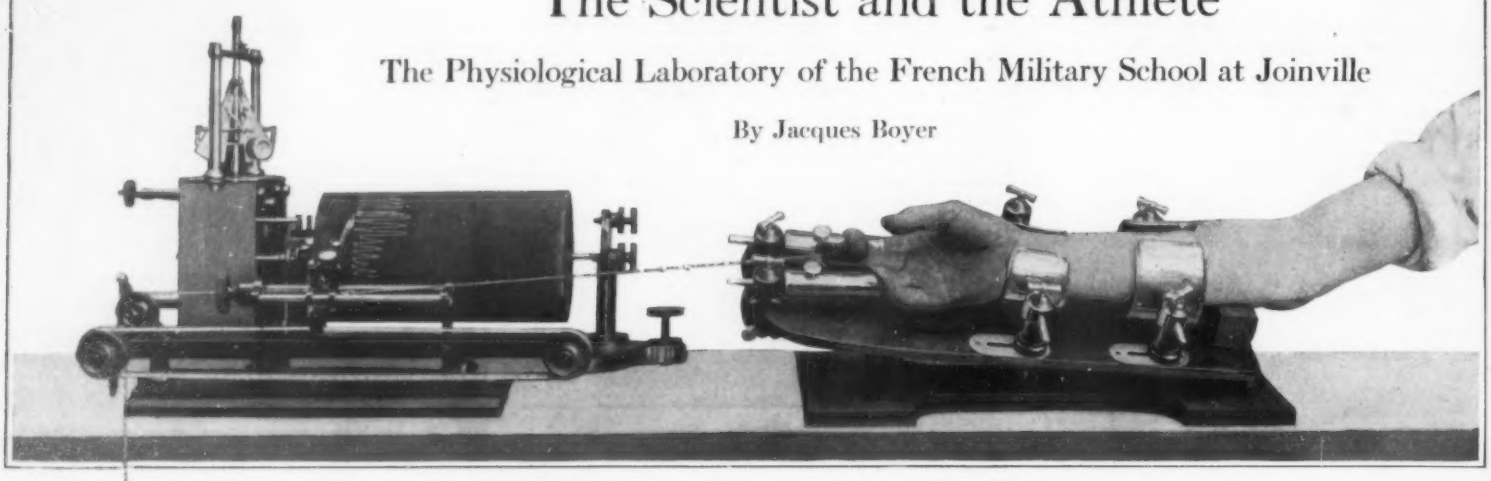
A passenger whom Noel took up in an 80 horse-power Le Rhone-Morane-Saulnier machine says in the same issue of *Flight*:

"My own impressions of looping are much the same as Noel's, but there is one point that has struck me particularly, and that is the fact that I could not realize that I was upside down. I did not feel any tendency to fall out, and if I had shut my eyes I would not have known, for the greater part of the time, that we were not flying normally. Before I ascended I took the precaution of seeing that what little coin of the realm I had in my pocket would not fall out when in an inverted position, but, as I found later, quite unnecessarily, for, once in a way, my money remained quite securely in my pocket. As far as I can put it in words, my sensations from start to finish were as follows: After climbing to a height of about 600 feet, Noel turned and inquired if I was ready, and then we dived slightly, the feeling in this case being similar to that during a *vol plané;* the ground stretched out before us, then suddenly 'rolled' out of sight as the nose of the machine was turned upward, and there was nothing but the clouded sky all round. The rush of wind, which had been intense, then seemed to die out altogether for a second or so, and now one felt that wonderful feeling Noel spoke of, of being absolutely alone and extraordinarily happy. The next sensation was exceptionally weird, for suddenly there was a terrific rush of air and the earth came into view from behind and above, and passed with startling rapidity in front of the machine, just as if some one had thrown a roll of green cloth over one's head from behind, so that it unrolled as it went. As the ground passed from overhead to the front of the machine, the sky again came into view overhead, coming up from behind as did the earth, and I realized then that we were diving and that we had been upside down. All this time I felt absolutely comfortable in my seat, and it was only when we were recovering our normal position that I felt any rough movement. Each time we made the loop we came out of the top of it slightly sideways, so that when the horizon line appeared above our heads it was not absolutely horizontal. As I said before, although I saw, for the space of two or three seconds, the ground stretched out above my head, I had no feeling of being upside down."

The Scientist and the Athlete

The Physiological Laboratory of the French Military School at Joinville

By Jacques Boyer



The Mosso ergograph, which registers the work done by the fingers.

At the normal fencing and gymnastic school which the French war ministry maintains at Joinville, systematic physical training is given to officers and men, and methods of improving the auxiliary service are investigated. Especial attention is given to perfecting the exercises and methods of training, with the aid of scientific researches carried on in the physiological laboratory of the school.

In addition to the counting and recording instruments which are commonly employed by physiologists and psychologists for the study of respiration, circulation, and muscular contraction, the laboratory contains several novel and interesting instruments invented by Prof. G. Demeny for the determination of the form and dimensions of the body at rest and in movement. The laboratory is also well equipped for work in photography, including chrono-photography and kinematography.

The dimensions of the thoracic cavity are measured with calipers having blunt tips of ivory. One of these tips is affixed directly to one leg of the instrument, but the other tip is attached to a rod which can move in a graduated slide against the pressure of a spring. This construction allows the calipers to be withdrawn without opening them or wounding the subject. When the instrument is applied to the chest the spring tip remains in contact with the body without interfering with respiration, so that the travel of the rod measures the augmentation of the thoracic diameter in the act of inspiration. By connecting the rod with a pair of Marey capsules, a continuous record of the variations in diameter can be inscribed on a rotating cylinder.

In order to obtain more precise measurements of all dimensions of the body, Prof. Demeny has devised an instrument, the double universal conformator, which can be adjusted to trace on paper outlines of the median vertical section of the trunk, and of horizontal sections at various heights. The essential organ of this apparatus is a metal rod, to which numerous thin strips of wood, forming a continuous series, are attached transversely in such a manner that each strip can move independently in a direction parallel to its length (or at right angles to the rod) and that all the strips can be fixed in position by turning a nut at the end of the rod. The ends of all the wooden strips are brought into contact with the body, and the nut is screwed down. The contour of the body can be traced on paper from the profile of the strips thus immobilized.

With two such rods, mounted parallel to each other on suitable supports, the form of horizontal sections of the body, or of its lateral or anterior and posterior vertical profiles can be determined very quickly. Complete horizontal sections of the chest at various levels are obtained by attaching four rods to a rectangular frame, inside which the man stands on a platform which can be raised to any desired height.

The Demeny conformator reveals immediately and without calculation any defect of symmetry, such as unequal height of shoulders or hips, abnormal curvature of the spine, etc.

For the special study of the spine an instrument called a sachigraph or profilograph has been devised. Four rods, connected by movable joints to form a rhomb, are supported by a carriage that moves in a slot in a vertical post. The subject stands with his back to the post, and the carriage is moved upward, while a blunt point attached to one vertex of the rhomb is pressed against his spine. Simultaneously, a pencil attached to the opposite vertex of the rhomb traces the profile of the spine, in its true dimensions, on a sheet of paper.

Vertical sections are obtained also by an instrument which traces the profile on paper by means of pencils attached to two rods, mounted on rollers, between which the subject is placed, and which measure the thickness of the body at every point as they move up or down.

The volume of air introduced into the lungs by a deep inspiration is measured by a very simple spirometer. The inhaled air is expelled through a rubber tube into a cylindrical bell-glass, which dips into water contained in a larger glass vessel. The cross-section of the tube is made equal to that of the trachea in order to minimize resistance and disturbance of the rhythm of respiration. The bell-glass is suspended by a cord which passes over two pulleys and has a counterpoise attached to its other end. The bell-glass rises as the air is blown into it, and if its wall were infinitely thin its rise, indicated by the emergence of an attached scale from the water, would be exactly proportional to the volume of air introduced, the pressure remaining constant. In practice, however, there is a small increase of pressure, which is measured by a manometer inside the bell-glass and is applied as a correction. The spirometer is calibrated by injecting air in measured quantities, one liter at a time, and reading both the water level scale and the manometer after each addition.

Many of the physiological researches that are conducted in this military school are executed by Marey's method, which is capable of furnishing graphic records of respiratory movements, the pulsations of the heart and the arteries, muscular contractions, the pressure of the feet on the ground in walking, leaping, etc. The part of the body which is being examined is brought into contact with the flexible membrane of a Marey capsule, which is connected by a rubber tube to a similar capsule, whose membrane carries a stylus that presses on a cylinder covered with blackened paper and turned uniformly by clockwork.

The variations of muscular effort are registered by the well-known ergograph of Mosso.

The mechanism of bodily movements is studied also by means of photography, kinematography, and, especially, chrono-photography. The kinematographic analysis of movements enables the physical instructor to discover the physiological consequences of various exercises, and to classify the latter according to their effects, but he must control his deductions by attentive observation of the movements.

Chrono-photography may be defined as the photographic reproduction of successive positions of a moving object on a single fixed plate. Graphic chrono-photography is based on the same principle, but it furnishes a much larger number of images in a given time. The pictures of this sort that are produced at the Joinville school are exceedingly interesting, and convey very valuable information in regard to walking, high and broad jumping, and other exercises. So, at Joinville, physiologists and trainers work together for the improvement of physical education.

The Anti-trust Bills and the Patentee

PATENTEES have concerned themselves but little with the proposed anti-trust legislation which will soon be presented to Congress in the form of what is known as the Clayton Bill; yet that measure contains provisions which will profoundly affect the marketing of patented inventions and which will certainly be objected to by inventors and by manufacturers of patented articles.

Every invention, great or small, means a revolution in its way—a revolution in the way of shaving your face, if the invention be a safety razor; a revolution in house-cleaning, if the invention be a vacuum cleaner; a revolution in communication, if the invention be a duplicating machine, such as a mimeograph; and a revolution in transportation, if the invention should be an airship or a locomotive. Revolutions are not popular, particularly when they mean a change in personal habits. When one reads of the trials and tribulations of inventors, big and little, it is immediately driven home that the great conservative mass of humanity receives new ideas about as cordially as a Czar receives nihilist bombs. The new invention must be introduced very gradually; the general public must be educated to its use artfully by newspaper propaganda, public demonstrations, and much advertising. Difficult as it is to market staple products, the task of inducing the public to take an interest in a new invention is far greater.

If the Clayton Bill becomes a law—and it seems certain that some form of anti-trust legislation will be enacted before Congress adjourns—inventors will find their progress still further impeded by formidable legal obstacles. The revised Clayton Bill provides that anyone who shall lease or sell in the United States, "goods, wares, merchandise, machinery, supplies, or other commodities, or fix a price charged therefor, or discount from or rebate upon such price, on the condition or understanding that the lessee or purchaser thereof shall not use or deal in the goods, wares, merchandise, machinery supplies, or other commodities of a competitor," shall be liable to a fine of $5,000, and to imprisonment of one year. It has been the practice among patentees to divide the market into territories, and to give enterprising retailers in each territory license for that territory, it being usually stipulated by the retailer either that he shall have an exclusive license for that territory or that a similar competing article is to be sold to any other retailer in the same territory at higher prices or on less favorable terms. Without some such arrangement the retailer's competitors will all reap the fruits of his sowing, and will compete with him for the market which his own efforts have alone created. To meet this entirely fair demand of the retailer, which the bill does not seem to condemn, the manufacturer, in turn, is entitled to fair protection. Since the patentee must depend upon the retailer to create the demand for the article against the competition of rival brands, and since the manufacturer must assure the retailer, for a specified period at least, extra reward for the retailer's extra efforts in pushing the article, it seems no more than fair that the retailer shall give the patentee substantial assurance that he will exert more than ordinary effort in selling the article. So long as the retailer carries in stock a rival invention or offers both inventions to his trade, the retailer cannot push either against the other. Indeed, by offering both inventions alongside each other in the same store, the retailer actually increases the live weight of rival competition against which the manufacturer is struggling in his efforts to get a foothold in the territory. The very least that the manufacturer can ask, therefore, is that for a specified period the retailer shall concentrate his effort upon the manufacturer's own invention. Without such assurance from the retailer the manufacturer cannot in turn give any assurance to the retailer of extra reward for extra effort; and unless the manufacturer can give such assurance he cannot hope to find a market for his invention in territory already occupied by his rivals.

The Clayton Bill forbids the manufacturer and retailer from making any such arrangement. Any manufacturer or patentee engaged in interstate commerce becomes a criminal if he attempts to secure an en-

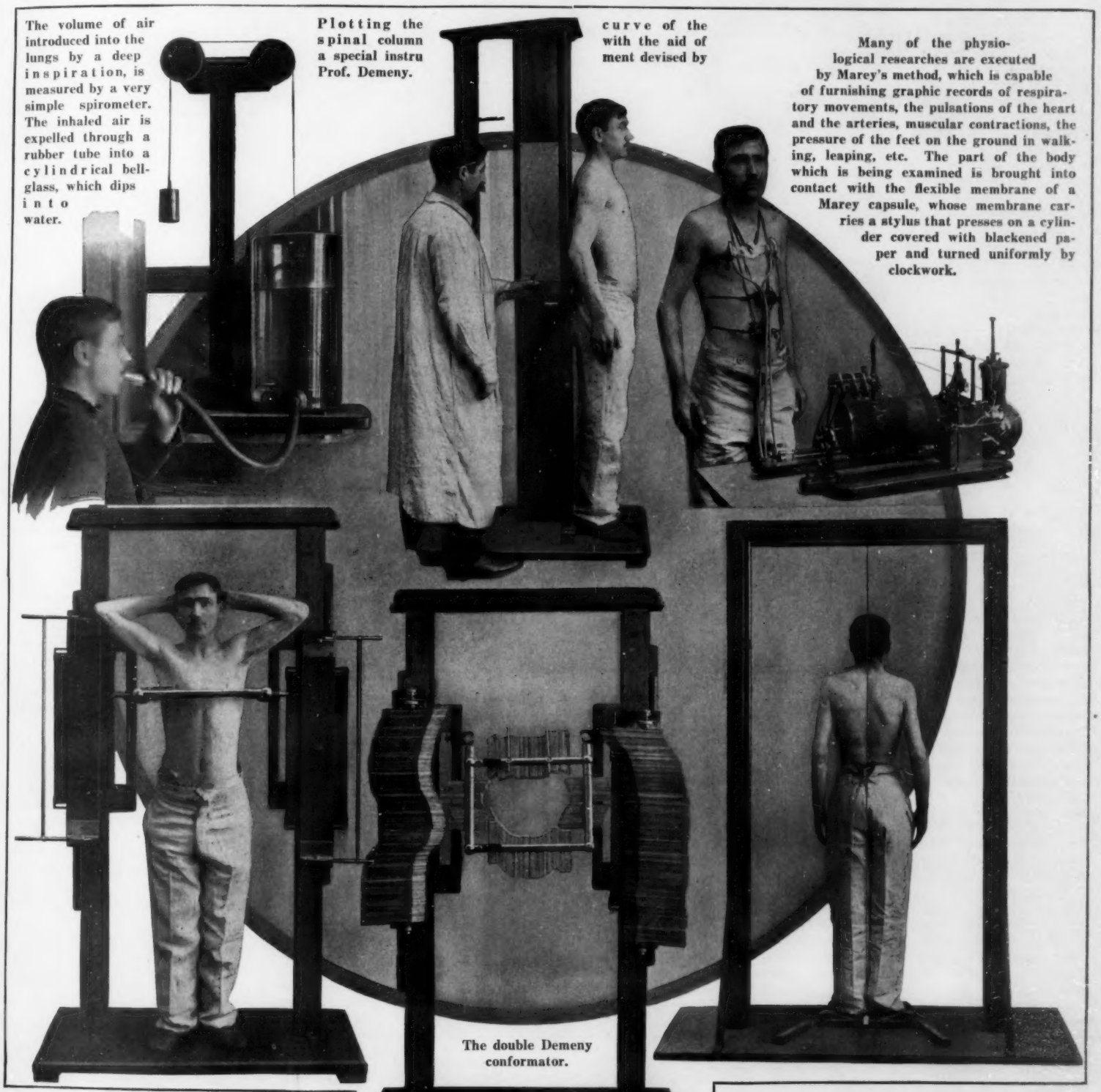
tire year's business as a condition of selling to a retailer; if he attempts to hold the retailer to an agreement to handle his patented articles exclusively; if he avails himself of the quality of his patented article to induce a retailer to "stock up" with that exclusively; or if he agrees in consideration of the retailer's agreement to handle his article exclusively that he will sell to other retailers only on less favorable terms.

The right to furnish repair parts—a very important right in marketing patented inventions—is affected by another provision of the bill. A manufacturer who sells a delicate machine whose successful operation depends upon perfectly adapted substitute parts, supplies, and supplementary appliances, agrees usually to furnish purchasers with such parts, supplies, and appliances, at a special price, upon the understanding that the imperfectly adapted parts, supplies or other appliances of other manufacturers shall not be used. It was brought out in the Dick case, for example, that the ink which purchasers of the mimeograph must obtain from the patentees costs no more than other ink, and that, being free from benzine, it will not dissolve the wax stencils. Other inks on the market, some of them perhaps cheaper than the ink supplied by the patentee, do contain benzine, with the result that the wax is dissolved, and that not more than two hundred or three hundred impressions can be obtained from a single wax stencil, with the result that the reputation of the machine suffers. It is possible to mention dozens of machines whose perfect operation depends upon the character of repair parts and supplies. Yet, under the Clayton Bill, a patentee may not protect the reputation of his machines by seeing that they are always operated under the best conditions.

Instead of agreeing to sell these perfectly adapted parts, supplies, and appliances at a special price, a patentee sometimes agrees to sell the original machine at a special price upon the understanding that the purchaser shall not use imperfectly adapted parts, supplies, or appliances of other manufacturers. This also is forbidden by the Clayton Bill.

But suppose a manufacturer sells no machine at all. Suppose that he only leases it, because he may be compelled to do so. The excavating machinery with which the Chicago Drainage Canal was built is an example in point. The machines in question cost $25,000 each, and there were probably not more than a dozen contractors in the whole United States who could afford to buy them. Realizing this, the manufacturers leased the machines under such favorable conditions that it was possible for any contractor to utilize them. As a result the Chicago Drainage Canal was dug at the unprecedented rate of 57 cents per cubic yard, instead of the usual 80 cents for rock excavation. The machines in question were leased on condition that certain supplies necessary for the perfect operation of the machines were to be obtained from the manufacturer. All this is forbidden by the Clayton Bill. Nor may the patentee seek to overcome the restriction by leasing the machines at a special rental upon the understanding that the lessees shall not use imperfectly adapted parts, supplies, or appliances of other manufacturers; nor may he agree to sell to the lessee perfectly adapted parts, supplies, or appliances upon the understanding that the lessee shall not use imperfectly adapted parts, supplies or appliances of other manufacturers.

Where is the stimulus to spend hundreds of thousands of dollars in devising new labor-saving machinery if this bill becomes a law? How will it be possible for a poor inventor with a good idea to interest a capitalist in his patent, if the capitalist finds it utterly impossible to market the invention in the most efficient way? Why must a man pay a fine of $5,000 and be subjected to a year's imprisonment like a common criminal because he follows business practices which good morals and honorable business conduct have sanctioned from time immemorial?



The volume of air introduced into the lungs by a deep inspiration, is measured by a very simple spirometer. The inhaled air is expelled through a rubber tube into a cylindrical bell-glass, which dips into water.

Plotting the curve of the spinal column with the aid of a special instrument devised by Prof. Demeny.

Many of the physiological researches are executed by Marey's method, which is capable of furnishing graphic records of respiratory movements, the pulsations of the heart and the arteries, muscular contractions, the pressure of the feet on the ground in walking, leaping, etc. The part of the body which is being examined is brought into contact with the flexible membrane of a Marey capsule, whose membrane carries a stylus that presses on a cylinder covered with blackened paper and turned uniformly by clockwork.

The double Demeny conformator.

The Demeny horizontal conformator in use.

Measuring the deviation of the spinal column from the normal.

The Vertical Distribution of Animals

THE accompanying drawing, reproduced from the *Illustrated London News*, shows the vertical distribution of animals in the five continents. The distance between the horizontal broken lines represents 3,000 feet. The highest point at which any animal occurs is shown by a black solid line beside the animal. The altitudinal range of the animals may extend in many cases as far down as sea level, and no animal is confined to the altitude at which it is drawn, but will extend some thousand feet lower than where actually placed.

The chief factors in the distribution of animals are suitable climate or temperature, and a suitable food supply. The food supply is obviously correlated with the temperature. In general, it may be said that the vertical or altitudinal distribution of life corresponds closely with the latitudinal or its distribution north and south of the equator. At high altitudes the temperature is cold, and we frequently find there the same type of animal that occurs at sea level in Arctic regions. Thus, essentially the same type of hare at 12,000 feet in the Alps will be found at sea level in northern Norway and Sweden. The llama, occurring at over 15,000 feet in the tropical Andes, is found at sea level in Patagonia.

The upper limit of animal life virtually corresponds with the lower limit of perpetual snow, and animals are much more abundant at lower levels, because of increased warmth and food supply. The upper part of the picture (Alps, Caucasus) represents Europe, all in the temperate zone, and shows the lower level of perpetual snow between 12,000 and 15,000 feet; while the lower portion of the picture shows the snow line at over 18,000 feet, due to the continents of Asia, Africa, and the two Americas lying partly in the torrid zone. Note that the chamois of the Caucasus is found at a slightly higher altitude than the chamois of the somewhat more northerly Alps. In Europe the woodcock is found as high as 7,500 feet, but in Asia it ranges up to 18,000 feet.

The most conspicuous mammal found at greatest height is the yak of Central Asia, attaining 19,000 feet and never occurring lower than 10,000. This is much exceeded in actual height by American vultures at 24,000. These, however, do not dwell at that altitude, but only attain it at times in their flight, obtaining their food and rearing their young at lower levels. Reptiles occur at relatively low levels, as shown by the viper (Caucasus, 8,000 feet). Insects for the most part prefer lower levels and warm climates, but may occur at high altitudes (spiders, beetles; Alps, 16,000 feet).

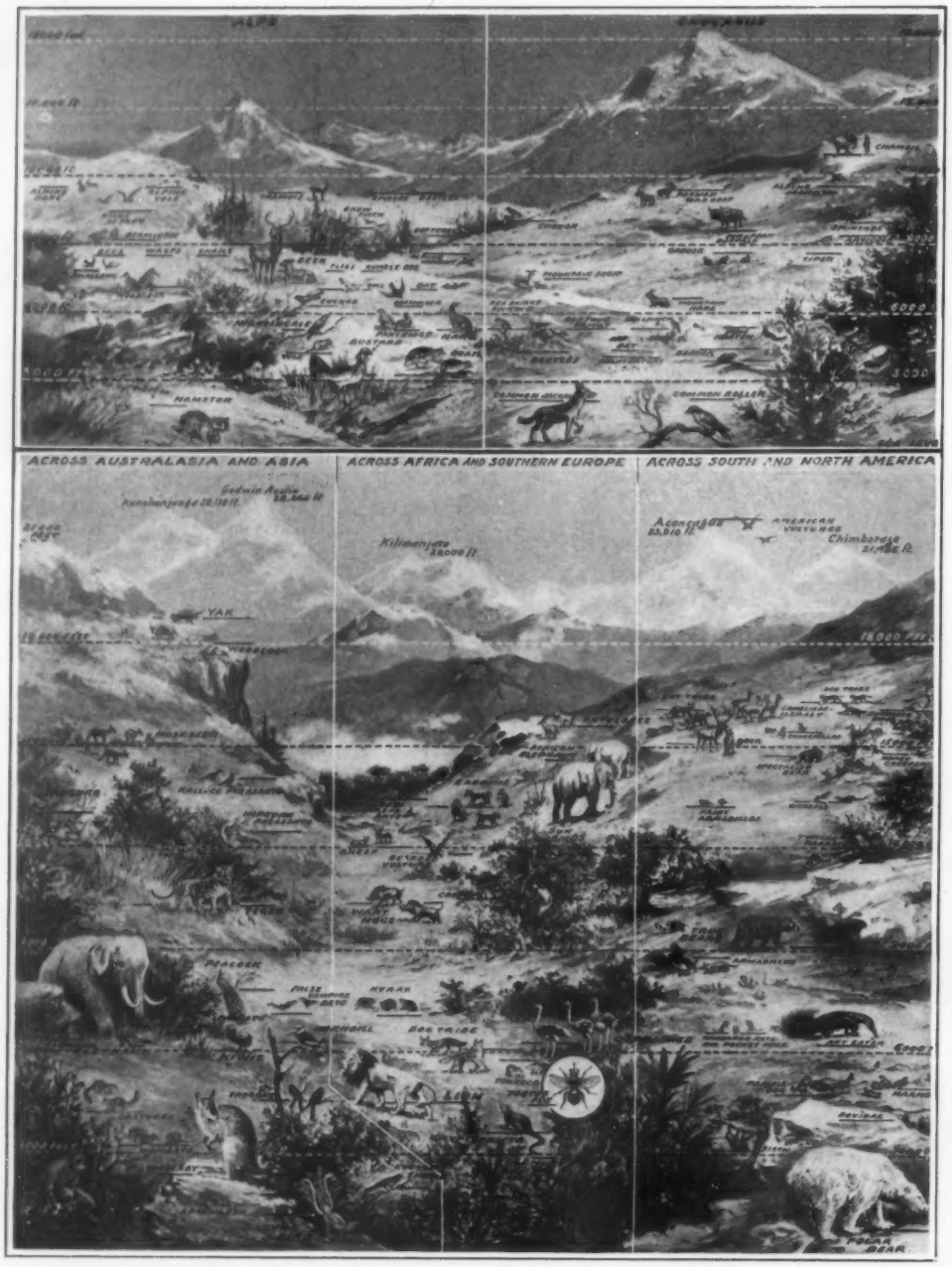
The extensive altitudinal range of certain animals or groups of animals is well shown in the section across South and North America; humming birds, from over 16,000 feet to sea level; armadillos, from 13,000 feet in the Andes to sea level in Brazil; deer, from 15,000 feet in tropical America to sea level in temperate and Arctic portions; bears, from the spectacled bear at nearly 16,000 feet in Ecuador and the true bears from 9,000 feet to sea level in temperate North America to the polar bear of the Arctic, never found more than a few feet above the ice of the ocean.

The high altitude attained by some animals is quite surprising. Note the African elephant at nearly 15,000 feet against the Indian elephant at scarcely over 6,000 feet, and observe where each would come if placed at similar heights in Europe. The high altitudes of certain monkeys is also interesting, with baboons and langurs at 13,000 feet, although apes, monkeys, and lemurs are essentially tropical animals, as shown by the orang, aye-aye, and lemurs, all under 3,000 feet. Sloth and anteater are also tropical animals, one reaching 3,000 and the other just over 6,000 feet in the new world tropics. The lion is more tropical than the tiger, being found at about 4,500 feet, while the latter ranges over twice as high, and is found near sea level in Siberia. The tse-tse fly is also tropical, occurring no higher than 4,500 feet in torrid Africa, so that one could dwell in Africa at over 5,000 feet and be safe from its ravages.

The peculiar animals of the Australian region, not found anywhere else, dasyures, wombats, kangaroos, wallabys, lyre-birds, and kiwis, etc., are tropical or temperate in nature and occur at relatively low altitudes, all under 6,000 feet. There are few high mountains in the region inhabited by them.

One important fact in the altitudinal distribution of life not shown in the drawing is that on mountains, the southern slopes exposed to the sun's rays are much warmer than the northern, so that animals are found at much higher altitudes on them than on the colder northern slopes of the same mountain. Also animals have a tendency to range higher in summer than in winter in the northern hemisphere, and of course the reverse in the southern hemisphere.

A knowledge of the vertical distribution of animals in any particular portion of the world is of value to man in indicating the climate of a region, of suitable crops for cultivation in such area, and of suitable breeds of animals to rear, and also in the selection of health resorts. There are parts of tropical Asia, Africa, and America, which to all intents and purposes belong to the Arctic or to the temperate zones, depending upon the elevation, and each is occupied for the most part by an appropriate assemblage of boreal or of temperate animals and plants.



This drawing, reproduced by courtesy of the "Illustrated London News," is designed to show the vertical distribution of animal life.

It is based on a series of maps which illustrate the distribution of over seven hundred families, genera and species of existing animals, and which constitutes volume 5 of Bartholomew's Physical Atlas, published at the Edinburgh Geographical Institute by John Bartholomew & Co., under the patronage of the Royal Geographical Society. While the drawing shows the highest point at which any particular animal is to be found, it does not indicate the range of that animal. The space between each pair of dotted lines represents three thousand feet.

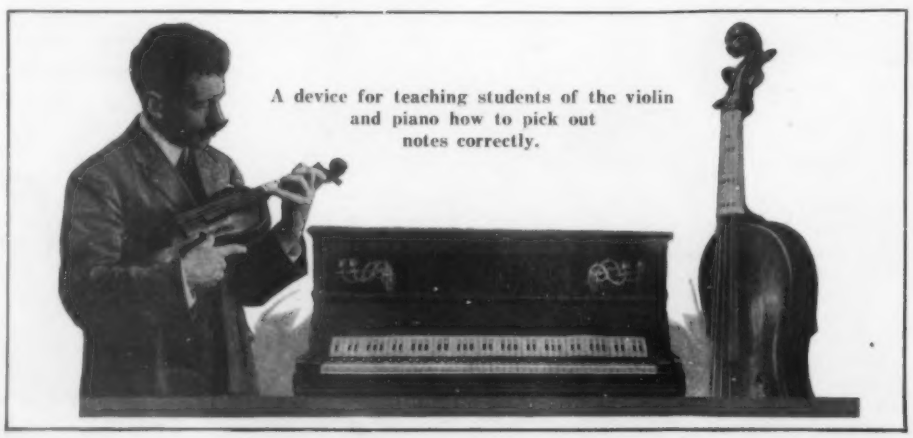
Some Helps for the Music Teacher

By Dr. Alfred Gradenwitz

IN the case of the piano, the sound corresponding to each note is invariably fixed on the instrument. Only a mistake in the key to be struck may result in grave disharmony. On the violin, and for that matter, on all string instruments, the pitch of each sound, however, depends on the position of the pupil's fingers, and since this in the beginning is practically never correct, no strictly correct sounds can be expected.

A distinguished violin teacher and composer, M. Frank Choisy of Geneva, Switzerland, has devised a simple attachment destined to obviate this drawback. The "joujuste," as this is called, is a mere sheet of paper on which the notes are inscribed

(Concluded on page 436.)



A device for teaching students of the violin and piano how to pick out notes correctly.

Frank Choisy and his inventions.

Courtesy of the *Sphere*. **Aeroplane bombs used in Morocco.**

Aeroplane Bomb in Morocco

THE Spanish army in Morocco has found the aeroplane a very effective means of coping with the guerrilla warfare of the natives. Two men in an aeroplane can sweep a wide area of difficult country and clear it of small bands or solitary snipers by dropping explosives upon them from a height above the effective range of their rifles. Needless to say, three dimensional warfare is not to the liking of the Moor. The sight of an aeroplane is in itself terrifying enough to the superstitious native. The accompanying photograph shows one of the Spanish military biplanes and the bombs that are thrown from it. By this means operations have been carried on against the Moors in regions where, hitherto, they have been safe from attack.

An Attachment for Talking Machines and Gramophones Which Improves Their Reproduction

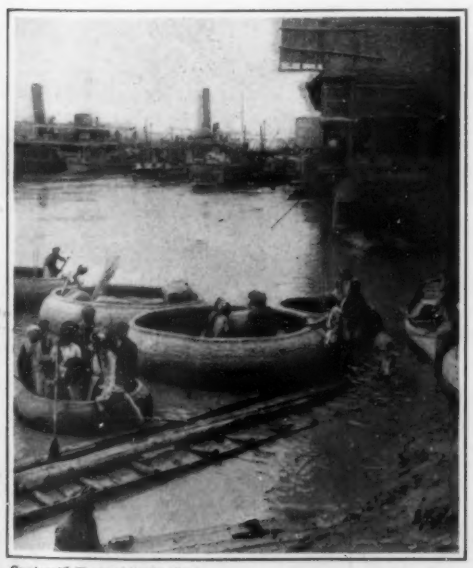
IN the SCIENTIFIC AMERICAN of September 27th, 1913, we published an article on an invention patented by Mr. M. B. Claussen for amplifying the reproductions of talking machine records, which invention consisted in inserting the steel reproducing needle through a specially formed celluloid disk. Simple as the invention is, the effect is remarkable. With a fine needle a volume of sound can be obtained which exceeds that produced by a coarse needle, with the additional result that all the delicate shades which only a fine needle can reproduce and which escape a coarse needle, are heard. Mr. Claussen has patented a modification which permits the use of the fiber needle. If anything, the effect of the celluloid disk is even more pronounced than with the steel needle. Those who use fiber needles know that they are superior to steel points because the scratching is reduced, the tone is purer, and the records are not worn away so quickly. Mr. Claussen passes the fiber needle through a ball and socket joint in the center of the disk, so the needle can be adjusted to any angle. It is now possible with this invention to use the fiber needle with those records for which it is peculiarly adapted, with the assurance that the sound to be obtained is greatly amplified and a richness of quality obtained otherwise quite impossible.

The Kufas of the Tigris

HERODOTUS, in the account of his travels, made note of the peculiar boats used on the Euphrates, as follows:

"The boats used by those who come to the city of Babylon are of a circular form, and made of skins. The ribs of the vessels are formed of willow boughs and branches. They are round like a shield, there being no distinction between the head and the stern. They line the bottoms of the boats with reeds. The boats have two oars, one man to each. One pulls to him; one pushes from him."

Very evidently that is a land of little progress; for circular boats are still to be found there, which fit exactly the specifications jotted down by the Greek historian. They are known as "kufas" and are in common use on the Tigris. The photograph shows a typical scene at Bagdad. The buoyancy and stability of the kufa is demonstrated by the boat in the foreground, which is about to land its passengers.

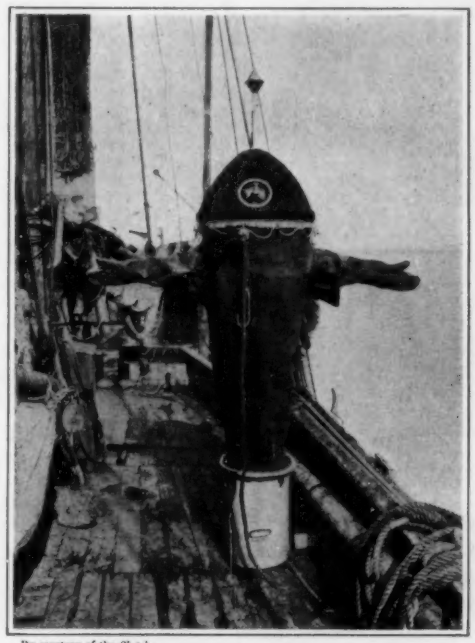


Courtesy of the *Illustrated London News*.

Odd circular boats used on the Tigris.

Curious Life-saving Suit

A GERMAN engineer has invented a very peculiar life-saving device, which is illustrated in the accompanying engraving. It consists of a water-tight canvas suit in the shape of a bag, with sleeves for the arms and a dome-shaped top that closes over the wearer's head. The sleeves terminate in gloves, so that no water can enter the suit through them. The top is provided with a porthole, through which the wearer may take note of his surroundings. However, a slide is provided to seal the porthole hermetically. Projecting from the top of the suit is a pipe through which air is admitted. In order to keep the device upright, a metal can or bucket is fastened to the bottom of the suit. There are openings in the top of the bucket, so that it will fill with water and act as a weight. Within the suit a limited stock of provisions may be carried. Around the top hand ropes are secured, to which two or three persons may cling and keep themselves afloat. The occupant of the life-saving device can propel himself by using his arms as paddles.



By courtesy of the *Sketch*

Peculiar life-saving suit.

Motor Stage Line Over a Desert

THE lapse of ten or, at the outside, not more than twenty progressive years has driven the far-famed stage coach from the highways of the West. To-day, where the railroads have not penetrated the motor stage holds undisputed sway.

There is an automobile stage running between Yuma, Ariz., and Holtville, Cal., which is truly a curiosity. Holtville lies at the eastern edge of the developed portion of the Imperial Valley. From there it is a jump of 56 miles across the desert to Yuma, Ariz. There is a railroad running from Yuma to Holtville, but it goes by a circuitous route, and costs the traveler much money and time. Accordingly, an enterprising man, George H. Johnson, undertook to establish a motor stage service. Before the loaded car had gone ten miles on its first trip, it was wallowing up to the axles in the sand of the Colorado River desert. After shoveling it out, Johnson spread long strips of canvas ahead of the machine, and in that way kept it out of the sand-holes to the end of the journey. But that was too slow a method of traveling. Service was discontinued until the problem was solved.

Johnson invented what we might call a "sand belt" to keep the machine from sinking into the sand, while it is crossing the desert. It is merely a set of threshing machine belts so arranged upon wood rollers that they travel over and under the rear wheels of the car, much in the same manner that the caterpillar engine's track rolls along beneath it when it is in motion. The belt is about a foot wide, and it runs upon a roller over each wheel, and another roller located about midway between each front and rear wheel. The belt is about half an inch thick, and it runs rather slack. It is easily attached and removed, and is substantial enough to hold the rear wheels out of the sand when it is crossing the desert with a load of passengers.

Sand belts to keep the wheels of the car from sinking into the sand.

How a Serious Accident May Be Prevented

A SERIOUS accident can happen with an automobile in case the driver stops it by simply cutting the ignition and braking, without putting the speed lever at the off point, for should the motor clutch remain on, the car will start off as soon as the crank is used to set the motor running. The driver thus risks being run over by his own car, or the vehicle runs wild at a high speed. An ingenious electric device can be used to make such an accident impossible, and it consists in mounting a relay so that when its magnets work, the relay contact cuts the ignition circuit. The magnet is in a battery circuit, which includes the crank, motor, and speed lever. The sector of the speed lever is specially made so that all the points except the zero point make connection with the circuit, while the zero point cuts the circuit. When the lever is on point 2, for instance, current can pass through the lever part to the magnet. Suppose the lever to have been left by mistake on this point, when the driver applies the crank against the motor for starting, he closes the circuit and operates the relay, thus opening the second or ignition circuit, which as stated is worked by the relay contact. Applying the crank thus cuts the ignition and it is impossible to start the motor until the lever has been shifted to the zero point on the sector.

Another Russian Gold Field

THE American consul general at Moscow reports that rich gold fields have been found in the district of Anadyr, Siberia, along the River Bielaya, consisting of a thick stratum of auriferous sand under a thin layer of peat. The difficulty of mining is great, owing to the fact that food and other necessaries cannot be procured nearer than at a distance of 200 to 300 miles.

Miniature Cyclone

THE freak cloud herewith illustrated was photographed at Whittier, Cal., following a heavy rainstorm. The cloud was very active, having a rapid spiral movement, at the same time traversing the sky with the group of clouds to which it seemed attached. It remained visible for perhaps an hour, but was ultimately broken up, apparently by its own violent movement.

Photograph of a miniature cyclone.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

LIFE-SAVING SUIT.—CARL G. WALLE, 33 Tompkins Place, Brooklyn, N. Y. This life-saving suit is designed to keep the wearer afloat in the water, while at the same time

LIFE-SAVING SUIT.

allowing convenient use of arms and legs for swimming and other purposes. The suit which is waterproof and air-tight is not only adapted for victims of accidents at sea, but also for hunters, fishermen and soldiers; in short for every one exposed to cold and dampness.

Of Interest to Farmers.

BEET-HARVESTER.—J. B. DAWSON, Box 57, Pompeys Pillar, Montana. This harvester is adapted for use with crowning mechanism previously patented by Mr. Dawson, but may be used with any other form of crowning mechanism. Means are provided for lifting the crowned beets from the soil without injury, separating them from the soil, and delivering them into a dumping container.

TRIP MECHANISM FOR BUNDLE-CARRIERS.—J. BAXTER, R. F. D. No. 3, Moscow, Idaho. To provide means for stopping the delivery of bundles or sheaves from a carrier; to provide means for manually releasing the bundles for delivery, and to simplify the mechanism for effecting these operations, are the principal objects of Mr. Baxter's invention.

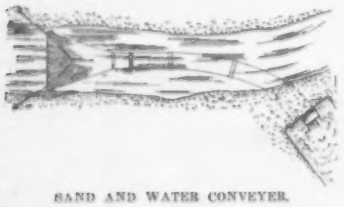
Of General Interest.

GRATING.—A. DARROCH, 369 Ninth St., Brooklyn, N. Y. This inventor's object is to provide a grating for use in roofs of subways, buildings and other structures, and arranged to prevent rain water, débris and the like from passing through the grating, to illuminate the space below the grating by refracted light, to

GRATING FOR SUBWAYS, BUILDINGS, ETC.

provide proper ventilation for the said space, and to close the grating in case of fire to prevent draft. To accomplish this result, use is made of grate bars provided with arched roofs open at one side, a building light extending under each roof below the opening thereof, and a ventilator under each roof adjacent the inner end of the said building light.

SAND AND WATER CONVEYER.—C. A. DEAL, 4209 Walnut St., Kansas City, Mo. This improvement relates to means for utilizing the current in a river, stream or channel for the purpose of removing sand from the bed of the



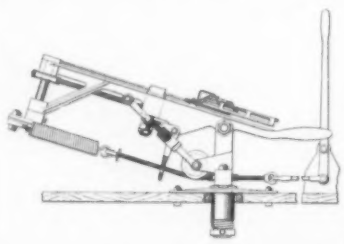
SAND AND WATER CONVEYER.

body of water and conveying it from a point up-stream to a point far enough down-stream to allow sufficient fall for the purpose.

SPARK ARRESTER.—S. E. PHEISTER, Yacolt, Wash. This improvement relates to a spark arrester to be applied to the smoke-stack of locomotives, stationary boilers, and donkey engines and other similar engines, and arranged to permit of the free escape of the smoke, while arresting the cinders, sparks, etc.

WINDOW-FITTING FOR BLINDS.—F. F. COWDROY, 311 Miller Street, North Sydney, New South Wales, Australia. To eliminate the damaging effects of repeatedly fixing brackets to window frames for shades of different width, Mr. Cowdroy has invented a fixture which may be permanently attached to the window and which has shade brackets adjustable laterally for various sizes of shades, and curtain pole brackets adjustable vertically for curtains of different lengths.

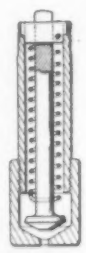
BLUE ROCK TRAP.—D. BEST, San Leandro, Cal. An object here is to provide a device having a frame which may be turned at any angle of the field, without causing extra strain, or having a tendency to pull the frame out of



BLUE ROCK TRAP.

position. A further object of the invention is to provide a device in which the rocks are caused to spin, and in which the throwing arm is automatically brought back into position ready for another throw.

AUTOMATIC DRAIN VALVE.—W. R. HUDDLESTON, Box 174, Brownsville, Tex. The purpose here is to provide a valve adapted for use in connection with the main reservoir of air



AUTOMATIC DRAIN VALVE.

braking systems, for automatically draining the reservoir and the system of water, wherein a normally open spring supported valve is provided, adapted to be closed by the pressure in the system, when such pressure exceeds the normal atmospheric pressure.

Hardware and Tools.

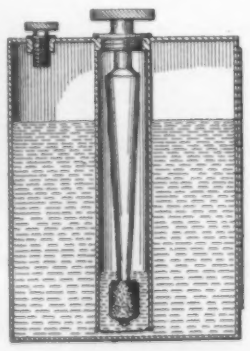
NUT LOCK.—A. H. WEGENER, 1105 Garden St., Hoboken, N. J. Among the objects of the invention is to provide an automatically gripping device for locking a nut to a bolt, but which will permit the unscrewing of the nut under force applied thereto by means of a wrench or the like without seriously damaging either nut or bolt thread.

FASTENING DEVICE.—M. J. MYERS, care M. J. Myers Co., 135 W. 26th St., New York, N. Y. The inventor provides a device which may be used on clothing and other articles, and which is constructed by providing a member with a longitudinally extending slot terminating at its ends in stud openings, one of which extends in the member at one side of the slot, and the other extends in the member at the other side of the slot.

SNAP HOOK.—C. E. KELLY, Griffin Corners, N. Y. With the present invention Mr. Kelly provides the catch with guiding means to control the same when it is moved into and out of locking position, and he secures the spring in fixed relation to the catch, so as to make the hook more easily operable.

Heating and Lighting.

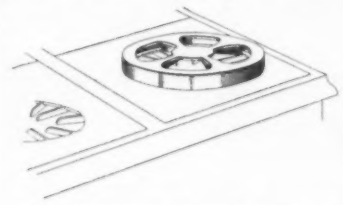
PORTABLE LIGHTER.—G. SCHLEICHER, 37 W. 14th St., Manhattan, N. Y., N. Y. Among the principal objects which the present invention has in view are: to provide a container to hold free liquid fuel for use in delivery in regulated quantities; to avoid flooding and



PORTABLE LIGHTER.

evaporation of the said fuel; and to prevent a variation in the delivery of the fuel from the said container. In the accompanying engraving a vertical longitudinal section of the portable lighter is shown.

STOVE-LID.—J. BRAUBACH, 107 Fourth St., Hoboken, New Jersey. The lid is adapted to be used on gas stoves of usual construction, being provided with shoulders adjusted to fit the sides of the opening in the stove top, to prevent the lid from sliding. The stove lid is



HEAT DIFFUSING LID FOR GAS STOVES.

provided with a centrally disposed disk with a series of holes clustered about it and a series of strengthening webs all with the purpose of diffusing under control the heat produced by the gas burner.

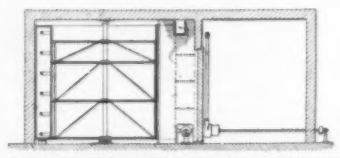
Household Utilities.

SAD-IRON.—J. W. AUSTIN, care of Central Flatiron Manufacturing Company, Binghamton, New York. This sad-iron is provided with means whereby the size of the mixing chamber for the gas and air can be enlarged or reduced at the will of the operator. The burning gas is utilized to the best advantage and all danger by back-firing is completely prevented, the usual chimney being dispensed with.

ATTACHMENT FOR COOKING UTENSILS.—C. N. SOWDEN, Guantanamo, Cuba. The invention provides a means for holding two sauce-pans or like utensils of different size, relatively spaced one within the other so as to constitute a double cooker. The attachment consists of a device which may be applied to the handles of the two utensils to hold them in the proper fixed relation to each other.

Machines and Mechanical Devices.

REFRIGERATING APPARATUS.—S. MACKIN, 1020 Santa Rita Ave., Laredo, Tex. The main object of the invention is to provide a means for hardening ice cream. The apparatus is provided with a series of shelves which may be revolved to bring them in position whereby the contents of the shelves may

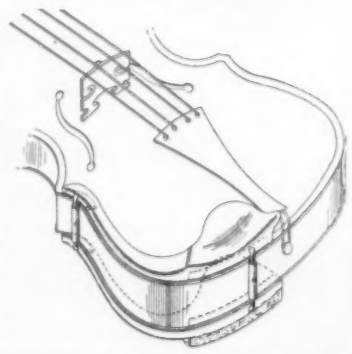


REFRIGERATING VAULT FOR HARDENING ICE CREAM.

be removed or replaced. The shelves are placed in a novel form of vault and novel means for maintaining the vault in cold condition are provided.

Musical Instruments.

VIOLIN CHIN REST.—C. J. EDLAVITCH, 12 Albemarle St., Baltimore, Md. By the use of widely spaced clamping members, this invention avoids creating a strain at a single point of the violin, which is often destructive. The



CHIN REST THAT AVOIDS STRAINING VIOLIN BODY.

inner portion of the chin and shoulder plates are prevented from coming into contact with the surface of the instrument. Such contact would destroy, in a measure, the tone of the instrument.

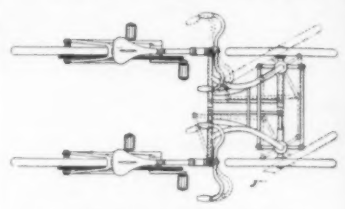
Prime Movers and Their Accessories.

MEANS FOR PROPELLING SHIPS AND THE LIKE.—S. GOUNOUILHOU, 8 Rue de Cheverus, Bordeaux, France. This invention has for its object a system of propulsion for ships and the like by means of wheels, and has more particularly for its object to direct the fluid jets projected by the wheels in such a manner as to bring them into a horizontal direction and utilize their *vis viva* for the propulsion.

ROTARY EXPLOSIVE-ENGINE.—J. D. BLAYNEY, Edmonton, Alberta, Canada. The apparatus consists of a series of explosive engines grouped about a central driving shaft. Each engine drives a pinion meshing with a large gear upon the driving shaft, the object being to obtain greater power, considering the size and weight, and smooth running because of equal distribution of applied power and proper balancing of the parts.

Pertaining to Vehicles.

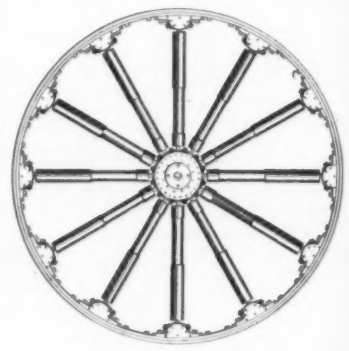
STEERING GEAR FOR VEHICLES.—A. OTTER, 1863 Linden St., Ridgewood, N. Y. This invention relates to steering gears for vehicles and has particular reference to means of this character for use in connection with compound



STEERING GEAR FOR VEHICLES.

cycles or devices which are propelled by the riders or by motive power. More particularly stated the invention contemplates the employment of two bicycle constructions made or connected in parallel and with a single steering mechanism for the combined wheel.

RESILIENT WHEEL.—A. T. GOOKIN, 50 Dana St., Cambridge, Mass. This improvement involves a new form of resilient wheel, and the principal purpose of the invention is to provide an improved device of this class. A further object is the provision of a wheel made



RESILIENT WHEEL.

up of a hub and rim with a number of resilient spokes therebetween, whereby when the wheel rolls over the ground the resiliency of the wheel will take up the shocks due to unevenness of the road.

DOOR-LOCK.—W. J. FLEISCHAUER and H. RICHARDSON, 10 Edison St., Pontiac, Michigan. The invention provides an improved lock of the type particularly adapted for use on automobile doors. It consists of a strong and durable construction embodying a minimum number of parts so co-operating as to prevent the door from rattling when closed.

WATER, LAND, AND AIR MACHINE.—E. E. GREGORY, Central City, Ky. The invention provides a hydro-aeroplane adapted to run on land. Hence, this vehicle may be used as an aeroplane, as a boat or as a land vehicle, without any change in device when going from one element to the other. The vehicle is provided with a novel form of hull for use on the water which serves as a main sustaining plane when used in the air.

Designs.

PAPER BELL.—B. KARFIOL, care of Royal Wastepaper Works, 842 Lorimer St., Brooklyn, N. Y. The bell is of the folding paper type, and has parallel horizontal stripes of various solid colors extending through it.

WEDDING RING.—M. ROSEN, 1167 Vipe Avenue, New York. A distinctive characteristic of this design is that annular spaces of even width extend about the ring to show both at the outer and inner surfaces thereof.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

"SIXES" RUN 32.8 MILES ON ONE GALLON OF GASOLINE

NINETY-FOUR CARS MAKE STARTLING AVERAGE IN "FRANKLIN" TEST

"Stock" Machines With Three Passengers Each Make Simultaneous Record Runs in All Parts of United States

VICTORY FOR LIGHT-WEIGHT IDEA

Many Dealers, Sold Out, Compelled to Borrow the Machines of Local Owners to Take Part. Varying Weather Conditions Met.

Syracuse, N. Y.—On May 1st, 94 Franklin dealers in the United States and Canada, in 94 Franklin Six-Thirty stock touring cars, regardless of weather conditions, made a test to demonstrate the best possible mileage on 1 gallon of gasoline.

The rules required that the finish be as near the starting point as possible. Each test was made with two official observers, and results sworn to before a Notary Public. The test represents the average of 94 cars, 94 drivers, various road conditions, all kinds of weather, different grades of gasoline and, therefore, what can be obtained by skillful driving in the scientifically light-weight six-cylinder Franklin car.

The highest mileage, 51.2 miles, was made by Wm. F. Sanger, Milwaukee, Wis.

The different conditions under which the tests were made are graphically shown by the following telegrams:

Salt Lake City, Utah—"40.1 miles. High wind and wet roads or could easily have made 50."

Laramie, Wyo.—"32.1 miles. Weather cold. Roads rough but hard."

San Diego, Cal.—"33.1 miles. Roads very slippery. Drizzling rain during run. Rather cold. Conniry drove. Top and glass front down. H. C. Covell, Club Representative; Louis Elmgren, Fire Chief; observers. Car with load weighed 3385."

Georgetown, Texas—"Made 17.2 miles. Top and windshield up. Wet and badly washed pike roads. Very little wind. Three passengers and car weighed 3310 including accumulated mud. Showered just before starting. Average speed eighteen miles per hour. Affidavit follows by letter."

Bangor, Maine—"21.5 miles. Dry dirt roads, rough in places, and hilly. Weather cold, thermometer 31 at six, 45 at end of run. Strong wind. Driver Hall. Weight 3250. Glass front and top down. Snowed lightly during night. Started at ten, finished at eleven-thirty."

Newark, N. J.—"On official test obtained 34-4/10 miles. Roads dry, fair condition. Weather clear, mild. Driver Walter Parcells. Weight of car including passengers 3320 pounds. We doubled back over identical course. Course contained 15 hills (grades from 2 to 8 or 10 per cent). Demonstrating car used, run total 5,000 miles covered period 6 months."

York, Pa.—"Made thirty-seven and nine-tenths miles on turnpike which was covered one tenth of way by deep blue stone. Can do forty-five miles if roads are in good condition."

Kansas City, Mo.—"Williams makes forty-two and eighty-eight hundredths miles on one gallon gasoline. Weather cool. Slight wind. Roads good."

(Continued in booklet, sent free on request by Franklin Automobile Company, Syracuse, N. Y.)

THE MILWAUKEE TEST CAR JUST IN—51.2 MILES ON ONE GALLON

THE CERTIFIED INDIVIDUAL RECORDS

City	*Dealer*	*Weather*	*Record*
Milwaukee, Wis.	Wm. F. Sanger	Fair	51.2
Aberdeen, S. D.	G. M. Worthington	Fair	46.3
Akron, O.	A. Auble, Jr.	Windy	39.3
Albany, N. Y.	C. G. Heck	Windy	33.1
Auburn, N. Y.	George H. Leonard	Windy	36.6
Baltimore, Md.	W. F. Kneip	Windy	36.0
Bangor, Me.	Edwin O. Hall	Windy	21.5
Bar Harbor, Me.	Fred L. Savage	Fair	36.1
Binghamton, N. Y.	S. H. Lewis	Fair	32.5
Boston, Mass.	Otto A. Lawton	Fair	40.5
Bridgeport, Conn.	Arthur L. Clark	Windy	34.4
Buffalo, N. Y.	George Ostendorf	Windy	27.7
Canton, Ohio	Geo. W. Belden	Fair	30.9
Charlotte, N. C.	J. B. Woodside	Windy	36.0
Chicago, Ill.	F. H. Sanders	Fair	31.2
Cincinnati, O.	Newman Samuel	Fair	37.3
Colorado Springs, Colo.	G. W. Blake	Rain	30.0
Cumberland, Md.	A. E. Glisan	Fair	30.9
Dallas, Tex.	W. G. Langley	Windy	25.9
Dayton, Ohio	F. B. Heathman	Fair	33.2
Denver, Colo.	F. C. Cullen	Rain	26.3
Duluth, Minn.	D. Peacha, Jr.	Windy	32.7
Eau Claire, Wis.	G. R. Wood	Fair	23.7
Edmonton, Alta.	Holland W. Ross	Fair	30.3
Elizabeth, N. J.	F. V. Price, Jr.	Windy	41.2
Erie, Pa.	John Griffith	Windy	30.5
Galesburg, Ill.	E. T. Byram	Fair	20.2
Geneva, N. Y.	W. W. McCarroll	Fair	36.7
Georgetown, Tex.	T. J. Caswell	Rain	17.2
Grand Rapids, Mich.	John Vlasblom	Fair	22.5
Great Falls, Mont.	B. D. Whitten	Fair	31.4
Greensburg, Pa.	E. L. Turner	Fair	25.7
Hagerstown, Md.	H. E. Baker	Fair	35.3
Hartford, Conn.	H. P. Seymour	Windy	33.8
Hoosick, N. Y.	John Moseley	Fair	36.5
Hutchinson, Kans.	L. B. Young	Fair	25.0
Kansas City, Mo.	E. F. Williams	Cool	42.9
Kingston, N. Y.	William M. Davis	Windy	31.7
LaCrosse, Wis.	Alfred James	Fair	26.0
Laramie, Wyo.	E. Loveioy	Fair	32.1
Little Rock, Ark.	J. F. Jones	Fair	34.1
Los Angeles, Cal.	R. C. Hamlin	Rain	24.6
Louisville, Ky.	George M. Younger	Fair	36.1
Minneapolis, Minn.	L. A. McKay	Windy	42.8
Newark, N. J.	W. L. Mallon	Fair	34.4
Newburgh, N. Y.	George Mason	Fair	33.9
New Haven, Conn.	Cowles Tolman	Fair	48.6
New York City	G. A. Tisdale	Windy	39.4
Norwich, N. Y.	A. M. Jones	Windy	30.0
Oakland, Cal.	Frank Bartels	Windy	31.5
Paterson, N. J.	J. S. Hughes	Fair	25.1
Pendleton, Ore.	J. W. McCormmach	Fair	33.9
Peoria, Ill.	S. K. Hatfield	Fair	32.2
Philadelphia, Pa.	James Sweeten, Jr.	Windy	38.2
Phoenix, Ariz.	George Hageman	Rain	29.6
Pittsburg, Pa.	W. Murray Carr	Fair	36.5
Portland, Me.	W. M. Chellis	Fair	26.2
Portland, Ore.	J. C. Braly	Fair	39.1
Poughkeepsie, N. Y.	William M. Davis	Windy	31.6
Providence, R. I.	Wallace L. Wilcox	Windy	34.4
Putnam, Conn.	O. C. Bosworth	Windy	33.3
Reading, Pa.	James M. Kalbach	Fair	27.9
Rising Sun, Ohio	E. F. Day	Windy	24.0
Rochester, N. Y.	G. R. MacCollum	Windy	34.8
St. Louis, Mo.	Jos. B. Dryer	Fair	37.9
St. Paul, Minn.	A. H. Clark	Fair	32.5
Salt Lake City, Utah	J. E. Langford	Wet	40.1
San Angelo, Tex.	M. C. Ragsdale	Rain	28.3
San Antonio, Tex.	L. F. Birdsong	Rain	30.9
San Diego, Cal.	Wilson S. Smith	Rain	33.1
San Jose, Cal.	L. Normandin	Fair	34.9
San Francisco, Cal.	John F. McLain	Windy	36.1
Scranton, Pa.	O. D. DeWitt	Fair	31.7
Seattle, Wash.	W. A. Wicks	Fair	43.0
Sheboygan, Wis.	N. P. Hanson	Windy	28.6
Shreveport, La.	W. H. Johnson	Fair	23.7
Sioux City, Ia.	Thomas Murphy	Fair	39.6
Sioux Falls, S. D.	Knapp Brown	Fair	28.1
Spokane, Wash.	J. A. Nichols, Jr.	Windy	42.5
Springfield, Mass.	W. W. Anderson	Fair	26.8
Syracuse, N. Y.	T. A. Young	Windy	40.3
Tulsa, Okla.	W. P. Chapple	Fair	24.8
Uniontown, Pa.	C. W. Johnson	Windy	18.9
Utica, N. Y.	W. W. Garabrant	Windy	30.4
Victoria, B. C.	G. H. Grant	Fair	22.0
Walla Walla, Wash.	R. H. Tuttle	Windy	34.0
Washington, D. C.	David S. Hendrick	Windy	32.4
Washington, Ia.	Sidney S. Smith	Fair	26.2
Waterloo, Ia.	R. H. Cramer	Wet	35.1
Wilkes-Barre, Pa.	William S. Lee	Windy	31.5
Winnipeg, Man.	James B. Stephens	Fair	38.0
Worcester, Mass.	V. J. Eckberg	Windy	34.3
York, Pa.	T. S. Pfeiffer	Windy	37.9
Youngstown, Ohio	J. Stuhldreher	Windy	28.4
	AVERAGE		**32.8**

FRANKLIN SIX-THIRTY, 2725 POUNDS, 4½ INCH TIRES

Training Marksmen by the Kinetomatograph

(*Concluded from page 423.*)

light was shining, becomes shifted a quarter of an inch, and is thus obliterated, the screen presenting an opaque surface to the firing line once more. By moving the back or third sheet at intervals in a horizontal direction the possibility of a series of holes—one in each sheet—coming into line and indicating a false hit is rendered extremely remote.

When the rollers have become exhausted of paper it is only necessary to change them, thereby permitting the paper to be used again. As a rule the picture is kept stationary upon the screen for about two seconds, which is quite adequate for determining the effect of the shot.

The pictures are projected at the normal speed—16 per second—and at first sight it may be thought that the almost brutal instantaneous starting and stopping of the projector mechanism would injure the film. But such is not the case. The wear and tear upon the celluloid ribbon is no more severe than when it is run through the lantern in the usual manner.

Holding the picture stationary in the gate under full illumination, however, presented one difficulty. As a rule, if a film is arrested and held for only a fraction of a second it will ignite, owing to the intensely concentrated heat brought to bear upon it. Although ordinary films are used in this apparatus there is no risk of firing. A radiator is built around the condenser, which acts as a cooling tank, and this keeps the celluloid film quite cool during the period of rest.

The great advantage accruing from this "life target," as it is called rather appropriately, is the way in which it fosters quick sighting and snap shooting. This is the factor which appeals especially to military experts to-day. The recruit may be somewhat slow in these elements when he faces the target for the first time, and even twelve pictures per second is somewhat too rapid movement for him, but he soon realizes the new conditions and almost mechanically adapts himself to the life-like conditions. Within a few weeks he becomes as efficient a snap-shooter and marksman as could be desired and far more so than is possible by ordinary target practice.

Possibly the one objection to the system is that the range is point blank. It can be used only for short distances. The average firing distance is about 30 feet, which, with the modern service weapon, is too short to be likely of realization in actual service. This limitation arises from two sources. The first is the restricted widths in which the paper can be woven at the mill, as a big screen formed by attaching two or three widths together is impracticable, owing to the risk of light showing through immaturely prepared seams, and from mechanical difficulties attending the utilization of reels of paper say twenty feet wide. The second is an optical problem. Under present conditions 300 feet represents approximately the extreme distance at which a picture thrown upon a screen may be seen clearly. Consequently, when it comes to service practice with a magazine rifle, questions of trajectory and windage do not arise. This drawback, however, is of secondary importance in one respect, since practice with the target assures that desideratum which is essential to modern military conditions—to sight and fire quickly.

Some Helps for the Music Teacher

(*Concluded from page 432.*)

at the place corresponding with each of them on the four strings of the instrument. This sheet, which is made in various sizes, is slipped below the strings and fastened to the handle by moistening its gummed edges. The pupil has only to put the fingers of his left hand on the black dots corresponding to the notes, in order to produce every sound with absolute purity. At the beginning of instruction, this gymnastics of the fingers should preferably be made without bow, the latter being at first put empty on the strings.

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & CO., INC.

Inquiry No. 9358.—Wanted the name and address of maker of a machine to cut all granulate leather.

Inquiry No. 9359. Wanted the name and address of a firm that makes razor blades for all makes of safety razors.

Inquiry No. 9360. Wanted the name and address of parties making pipe fittings such as ferrules, stems and bowls such as could be used in the making up of calabash pipes for smoking.

Inquiry No. 9361. Wanted to buy a Nut Cracking Machine, especially good for Pecans.

Inquiry No. 9362. Wanted the name and address of the makers of a machine for splicing ties.

Inquiry No. 9363. Wanted the names and addresses of manufacturers of machinery for printing on intaglio copper plates.

Inquiry No. 9364. Wanted the name and address of buyer of mica in a crude state.

Inquiry No. 9365. Wanted the name and address of a manufacturer of machinery for embossing tin foil as is used in packing cigarettes.

Inquiry No. 9366. Wanted the name and address of a manufacturer of wire wheels, front axles complete with steering or separate, light sheet metal bodies, fuel tanks with cocks, pressed steel frames, mufflers, motors of the two-cylinder opposed type, cushions and many smaller parts for cycle cars.

Inquiry No. 9367. Wanted the name and address of a manufacturer of an automatic centering machine.

Inquiry No. 9368. Wanted, the name and address of glass-bottle manufacturers or glass blowers who can manufacture a glass bottle and perforate it with some 12 small holes, in large quantities for export, to sell at a popular price.

Inquiry No. 9369. Wanted, the names and addresses of users of Indian Steatite (Soapstone), Corundum and other Indian minerals, in quantities.

Inquiry No. 9370. Wanted the names and addresses of manufacturers of small wooden articles, particularly in such soft woods as pine and fir, for articles such as toys, furniture, etc.

Inquiry No. 9371. Information wanted where one could buy or have made to order machine to be used for making solid back brushes.

Inquiry No. 9372. Wanted the name and address of manufacturers of a collapsible box about 12 inches square. It must be strongly made to withstand rough usage in transit.

Inquiry No. 9373. Wanted the name and address of a manufacturer of machinery that will make twine out of scrap paper.

Inquiry No. 9374. Wanted the name and address of manufacturers of a powder paste which, when mixed with cold water, will make a white paste suitable for papering, costing no more than 3 cents per pound in ton lots.

Inquiry No. 9375. Wanted the name and address of the manufacturer of a separable fastener, invented especially for shoes and other articles.

This attachment serves not only to facilitate and accelerate in a remarkable degree the first stages of violin teaching, but to make up for past negligence in musical instruction, by training the pupil to a correct position of his fingers. About nine pupils out of ten may be said in this connection to be wanting in the accuracy conducive to correct playing. The figures 1, 2, 3, 4 correspond to the fingers of the left hand, aside from the thumb.

On the other hand, M. Choisy has endeavored to provide a similar help to beginners in piano playing. His "auxiliary keyboard" (*clavier simplificateur*), while not claiming to be anything like a substitute for the piano itself, can be used as a makeshift for practising and keeping up the dexterity of the fingers, without any instrument, the arrangement of the keys being the same as on the piano. The intention of the inventor, however, was mainly to remedy a defect only too frequent in the first stages of piano instruction, viz., confusion between the various octaves. In fact, even the most talented pupils are generally unable to recognize at a glance any notes situated above or below the five lines of the note system, the more so as sol-fa exercises, as generally practised, are after all, destined only for singing lessons. While this drawback could be helped by special sol-fa practice, adapted to the requirements of piano playing, this course would be rather complicated and trying to pupil and teacher alike.

M. Choisy's auxiliary keyboard obtains the same result in a far more simple manner, and thus greatly facilitates piano teaching. It is simply applied behind, and immediately beside the piano keyboard, and will be found readily to remain in position. Inasmuch as all the notes of the instrument are inscribed on the auxiliary keyboard, the pupil, in the event of any uncertainty about a given note, will immediately find the key desired. The more he thus acquaints himself with the various octaves of the instruments, the more will he be able to do without the auxiliary keyboard, until its help can be entirely dispensed with.

Arctic Mines

APROPOS of the collieries in Spitzbergen, which have frequently been pointed out as an interesting example of mines in high latitudes, it may be worth noting that much coal from Spitzbergen is shipped to Kiruna, in Swedish Lapland, latitude 68½ degrees north (about the same latitude as northern Alaska), for use in operating the richest and probably the largest iron-mine in the world. According to a recent consular report, this mine is operated the year around, employs about 1,600 men, and is expected soon to be shipping 10,000,000 tons of ore per annum. About 25,000,000 tons have already been taken out. After this year the mine will be operated by electricity, the power being brought from Porjus Falls, 150 miles distant.

New Magnetic Charts of the Globe, or at least of regions of the earth embraced between 50 degrees north and 50 degrees south latitude, will, it is hoped, be published by the Department of Terrestrial Magnetism of the Carnegie Institution in 1915. They will include the three magnetic elements, declination, dip, and intensity of field, and will be referred to the date January 1st, 1910, as the middle date of all the material secured by the department and co-operating institutions during the period 1905-1915. It now seems likely that the polar regions can also be included, in view of the renewed activity in polar exploration. It has been the practice of the department to lend apparatus, train observers, and furnish instructions for all polar expeditions giving promise of serious and extensive magnetic work.

Sir Ernest Shackleton, accompanied by Messrs. Wild and Marston, members of the forthcoming antarctic expedition, will visit Norway at the end of March for the purpose of testing under polar conditions the sledges to be used by the expedition.

SPORTING GOODS

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in Scientific American Supplement 1524. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

SCHOOLS AND COLLEGES

NEW BOOKS, ETC.

THE JOB, THE MAN, THE BOSS. By Dr. Katherine M. H. Blackford and Arthur Newcomb. Illustrated from photographs. Garden City and New York: Doubleday, Page & Co.

The man behind the machine is as important a factor as the man behind the gun on board a battleship; yet weeks and even months are spent in rearranging machinery with an eye to efficiency, and not ten minutes in selecting the men who will be charged with the care of that machinery. To bring system and order where hitherto there has been either chaos, or at the best reckless choosing, is the primary object of this book.

A plea is made for two principles: The establishment of a central employment bureau in every large organization and a character analysis of each employee, proposed or actually engaged, to determine his qualifications and fitness for a particular task.

The idea of a central employment bureau is one that must commend itself at once. When it is considered that shop foremen select their own men, and in so doing are frequently governed by blind prejudice, that their "hire and fire" method is not only unfair to the employee but extremely costly to the employer, there can be no question that within the next few years we will see the central employment idea firmly established. The authors have introduced it with success in several factories. In accordance with their system, shop foremen send their requisitions to the central employment bureau for men just as they send requisitions to the pattern or tool department for patterns and tools. Human material which they cannot use is sent back to be otherwise employed if possible, and not to be recklessly discharged.

As a matter of fact, very little material is actually sent back. That is due to the system of character analysis which Dr. Blackford has devised, a system which seeks to introduce method where hitherto there has been only guessing or intuition. Beyond question, a man's psychical attributes manifest themselves physically. Low brows, thick lips, shifting eyes, square jaws, have always symbolized well-known attributes, not only in novels but in the very practical affairs of daily life. Mental and other aptitudes Dr. Blackford has classified with their physical expression (skin texture, width of head, color, etc.) in a way that anyone can grasp. It is a matter of great importance, as practice has shown, whether a man who applies for a particular job is long headed or round headed, blonde or brunette, convex or concave in profile, high browed or low browed, fine skinned or coarse skinned. A scientific method takes the place of mere intuition and guessing.

The system as it is outlined in this book has been in successful use in many large organizations; how successful may be gathered from the fact that it has been adopted by more than one plagiarist who has palmed it off as his own. No doubt as it is more widely introduced, refinements and improvements will suggest themselves, but as it stands it is the first really scientific attempt to introduce definite principles, easily grasped, where there has been nothing but folly, ignorance and injustice.

THOMAS'S REGISTER OF AMERICAN MANUFACTURERS. And First Hands in All Lines. New York: Thomas Publishing Company, 1914. Sixth edition. 2,800 pp. Price, $15.

The Register has developed into a ponderous tome very much larger than Webster's Unabridged, and presents improvements both in content and arrangement. A new section has been added, containing 50,000 names in straight alphabetical order. From the name of a concern, one may thus locate its offices, branches, and line of manufacture. This list, like the main classification of the volume, carries symbols indicating the capitalization and size of the listed firm. There is no line of business that is not adequately covered by the Register. That there are more than 70,000 completely-indexed classifications is sufficient evidence that all available names, regardless of advertising patronage, are included. There is also an alphabetical list of trade names and special brands, showing the manufacturers of each. The Register affords the buyer immediate access to every possible source of supply; while to the seller it offers a compilation of possible customers with intimate information of their standing, in so far as this is indicated by money invested.

THE WORLD SET FREE. By H. G. Wells. New York: E. P. Dutton & Co., 1914.

This latest of Mr. Wells' books is a curious combination of his earliest and latest methods, for it is at once one of those magnificent flights of imagination which gave us the "Time Machine" and the "War of the Worlds," and the keen sociological perception which gave us the "New Machiavelli" and its successors. How the great world war started, how it was fought with the aid of aeroplanes and atomic bombs, how it became so terrible that the utter folly of fighting was driven home with telling horror, Mr. Wells sets forth with a vividness that stamps him as a literary artist of the first rank. To the scientist, of course, the most interesting feature of the book is the method in which the discoveries in radio-activity are given artistic treatment, a method which shows that in the hands of a master science offers possibilities that can hardly be overrated. The atomic bomb which plays so great a part in this story, although a creation of Mr. Wells, may be regarded as inspired by Soddy's "Interpretation of Radium." Wells argues that inasmuch as radio-active substances are constantly decaying and giving off energy as they do so, tremendous results could be obtained if the decay could occur with explosive rapidity. Trained scientist as he is, he presents his atomic bomb with an air of definiteness and conclusiveness that almost convinces one it exists.

Soldering and Brazing

for nearly all metals, including such difficult ones as cast iron and aluminium, have been the subjects of hundreds of paragraphs in the Scientific American Supplement. We quote a few of the more important articles, as follows:

Scientific American Supplement No. 1673—*Full Instructions for Mending or Welding Cast Iron*, gives both brazing solders and fluxes necessary.

Scientific American Supplement No. 1713—*Brazing Cast Iron and Other Metals*, gives detailed instructions for the whole operation, and formulas.

Scientific American Supplement No. 1644—*Soldering and Soldering Processes*, gives broad general information, and contains in particular a method for pulverizing solders and alloys of great use.

Scientific American Supplement No. 1667—*Some Soldering Appliances*, describes the blowpipe and the furnace in their various forms.

Scientific American Supplement No. 1481—*Soldering of Metals and Preparation of Solders* gives many formulas for soft and hard solders and fluxes.

Scientific American Supplement Nos. 1610, 1622, 1628 contain a series of three articles on Solders, covering the entire range of solders for all metals. No. 1628 contains formulas and instructions for *soldering aluminium*.

FOR 80 cents—the price of the eight numbers, postpaid, the purchaser of these Supplements has a complete treatise on the subject of Soldering and Brazing, containing formulas of the greatest value.

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Scientific American Supplement No. 1864—The Gyro Compass, its principle and construction.

Scientific American Supplement No. 1621—The Gyrostat for Ships describes the construction and application of the principle to prevent rolling of vessels.

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Scientific American Supplement No. 1694—Gyroscopic Apparatus for Preventing Ships from Rolling, takes up the Schlick invention described first in No. 1621, and discusses its action and results fully.

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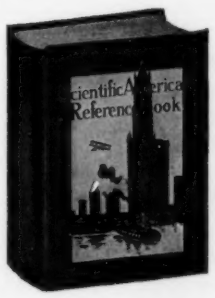

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